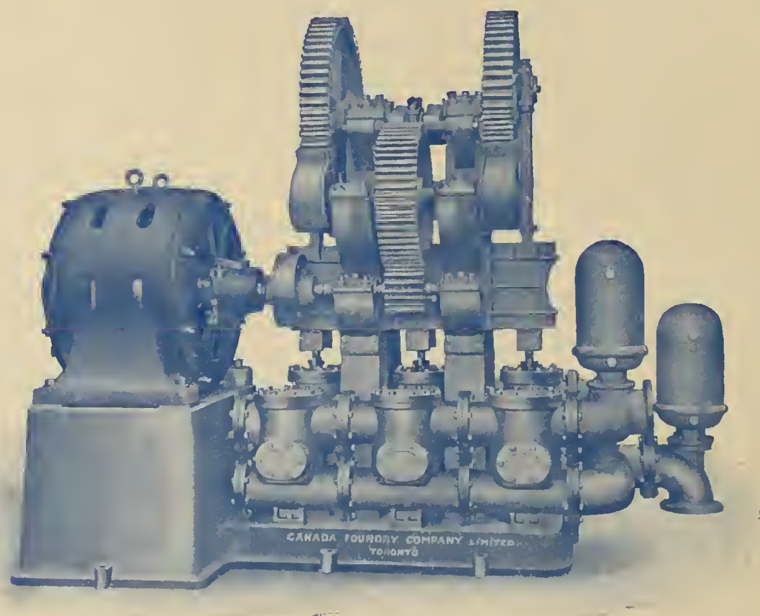
CANADIAN
MACHINERY
and Manufacturing News.

A MONTHLY PAPER DEVOTED TO THE MACHINERY AND ELECTRICAL TRADES, AND TO ALL USERS OF POWER.

VOL. XVII (Old Series) MONTREAL AND TORONTO, JANUARY, 1905 (New Series) VOL. I No. 1.

Alternating and Direct Current

MOTORS



Canadian General Electric Motor Direct Geared to Triplex Pump.

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We have installed them in factories all over Canada connected to many different kinds of machinery.

Higher efficiency—Increased production—Low cost of maintenance.

Write Us Your Requirements.

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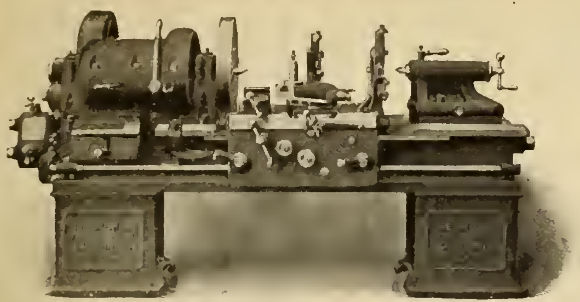
District Offices

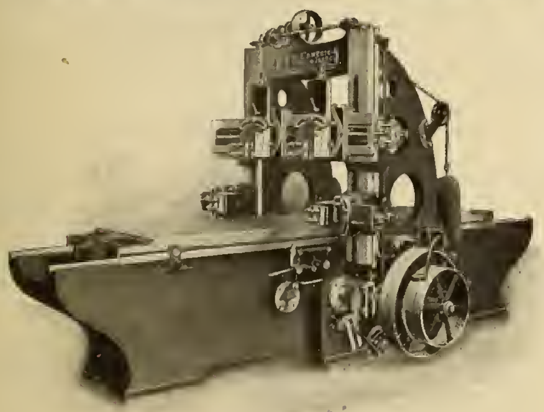
MONTREAL, HALIFAX, OTTAWA, WINNIPEG, CALGARY, VANCOUVER, ROSSLAND.



LATHES

14 in. to 60 in. swing.

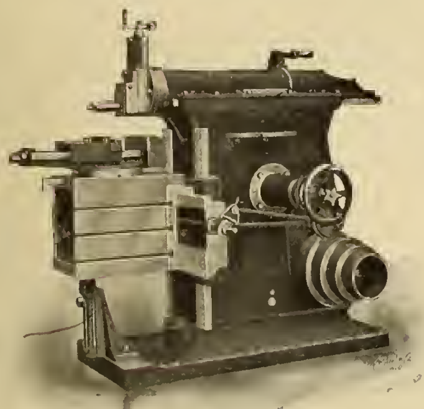
A 20 in. "American" Lathe with Patent Geared Head recently removed 7.52 lbs. of cast iron in one minute. An ordinary 20 in. lathe, tested to the limit, removed from the same bar 2.56 lbs.—a ratio of almost **3** to **1** in power delivered at the cutting tool.



PLANERS

22 in. to 72 in. between housings.

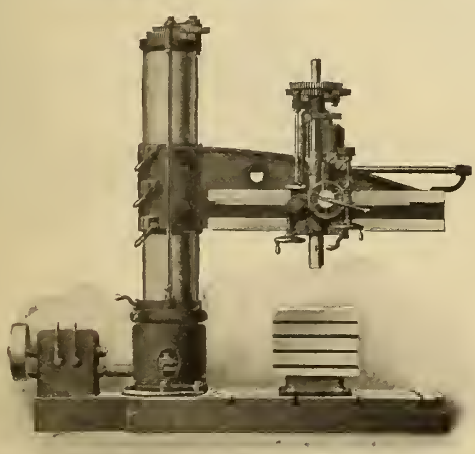
"American" Planers are built for high speed planing, and operate continuously in our works at cutting speeds of 20 ft. to 60 ft. per minute, dependent upon conditions.



SHAPERS

16 in. to 28 in. stroke.

The "American" Shaper is not a tool-room machine, but a manufacturing machine, with a cutting power exceptional in a shaper. It is susceptible of fine and positive adjustments without stopping the machine.



DRILLS

RADIAL DRILLS—3 ft. to 7 ft. arms
UPRIGHT DRILLS—
13 in. to 42 in. swing.

The "American" 4 ft. Radial drills a series of 15 holes, ranging from $\frac{1}{2}$ in. to $3\frac{1}{2}$ in. diameter through a 1 in. cast iron plate in **25 minutes**—the record for rapid drilling.

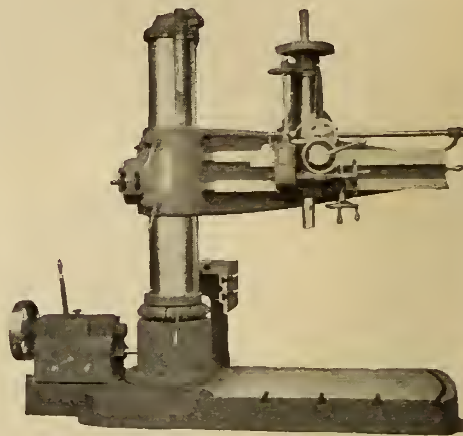
WE EQUIP ANY OF OUR MACHINES WITH IMPROVED ELECTRIC MOTOR APPLICATION.

THE AMERICAN TOOL WORKS CO.

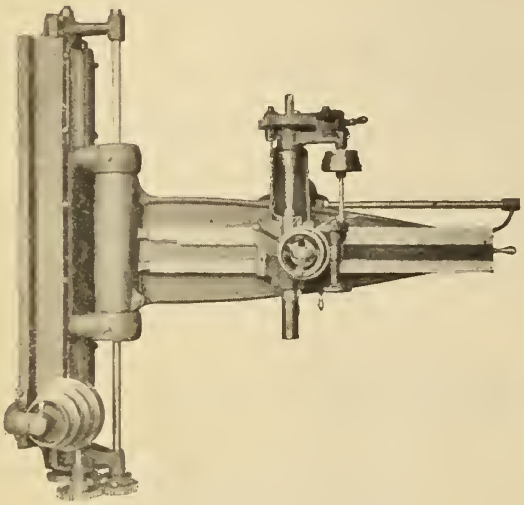
CINCINNATI, U.S.A.

BICKFORD DRILLS

The result of thirty years' experience in this one line of manufacture, our drilling machinery embodies everything that modern practice has shown to be essential to the **RAPID PRODUCTION** of **TRUE** work. Our plant is exceptionally efficient, being equipped with every modern appliance for the **ECONOMIC** production of **HIGH-GRADE** work.



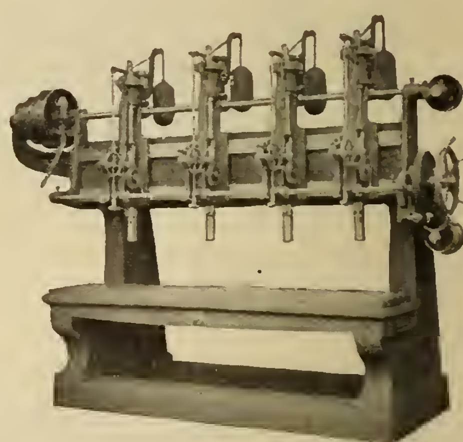
Improved Plain Radial.



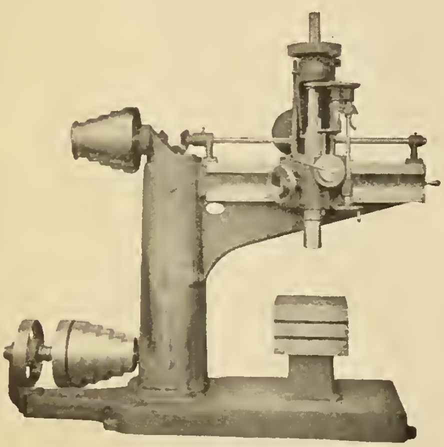
Adjustable Wall Radial.

We manufacture a complete line of Heavy Drilling Machinery, including such tools as Radial Drills—in Plain, Half and Full Universal styles—Multiple Drills, Wall Radials, Overhead Travelling Drills, Suspension Drills, Arch Bar Drills, Locomotive Frame Drills, etc.

Send for our Catalogue—it describes our complete line and is free for the asking.



12 in. Multiple Drill.



Semi Radial.

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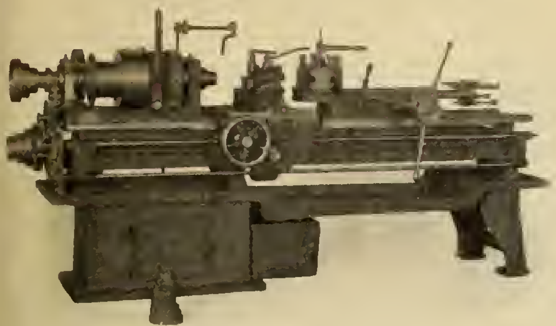
93-A

THE A. R. WILLIAMS MACHINERY CO., Limited

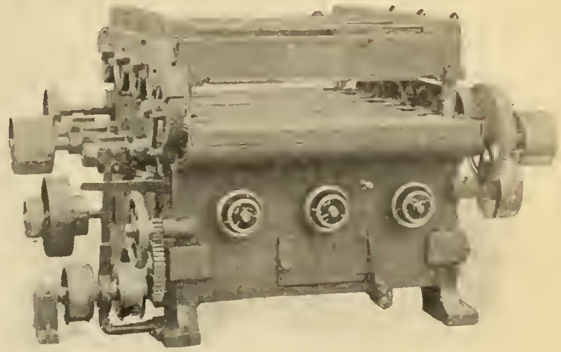
TORONTO



New Type Turret Lathe.

Branch: MONTREAL.

Branch: WINNIPEG.



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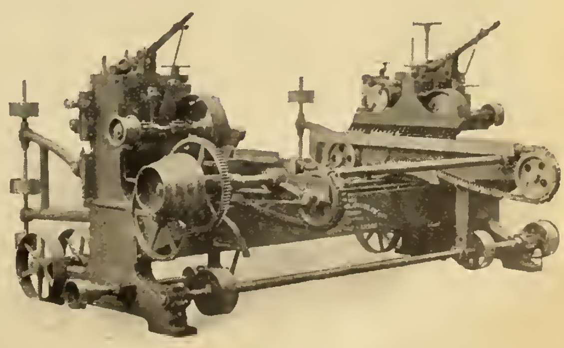
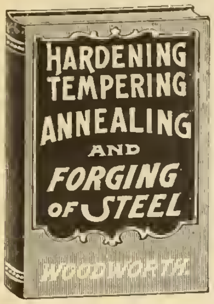


Double End Tenon Machine.

TECHNICAL BOOKS



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This is a new work treating clearly and concisely on modern processes for Heating, Annealing, Forging, Welding, Hardening and Tempering of Steel. It is a book of exceptional value to metal-working mechanics, giving directions for the successful hardening and tempering of all steel tools, including milling cutters, taps, thread dies, reamers (both solid and shell), hollow mills, punches and dies, the various metal-working tools, shear blades, saws, fine cutlery, metal-working and metal-cutting tools, and other implements of steel both large and small. Simple and satisfactory hardening and tempering processes are described.

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Their Construction, Operation and Manipulation, Including both Hand and Machine Tools.

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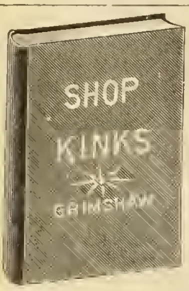

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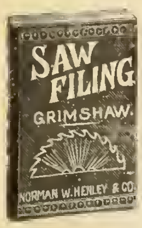

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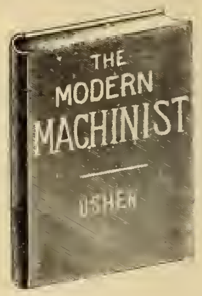

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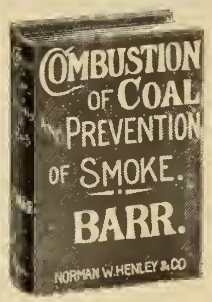
Specially Adapted for Machinists, Apprentices, Designers, Engineers and Constructors.

A practical treatise embracing the most approved methods of modern machine shop practice, and the applications of recent improved appliances, tools and devices for facilitating, duplicating and expediting the construction of machines and their parts.

A new book from cover to cover, which every machinist and practical man should possess. Every illustration in this book represents a new device in machine shop practice.

Special Chapters on Measuring Instruments, Vice Work, Chasing, the Erection of Machinery, Planing, Shaping, Slotting, Milling, Lathe Work, Drilling, and many other kindred topics considered point by point. This work is thoroughly up-to-date and was written by one of the best known and progressive machinists of the day.



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To meet the rapidly growing demand of recent years for turbine water wheels, there have been many types of wheels, more or less successful, placed on the market.

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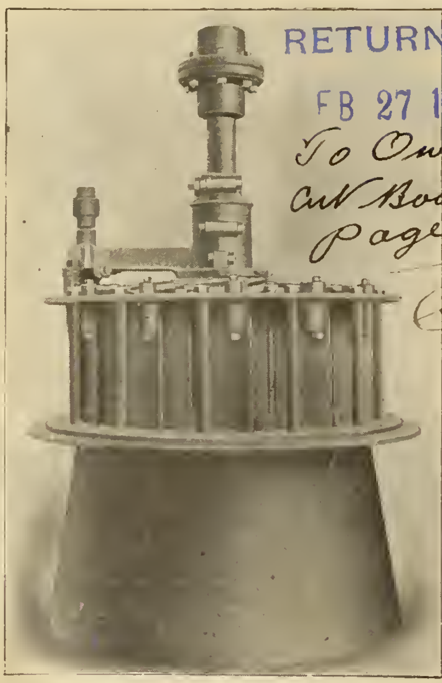
And there is over a million horse power in actual use.



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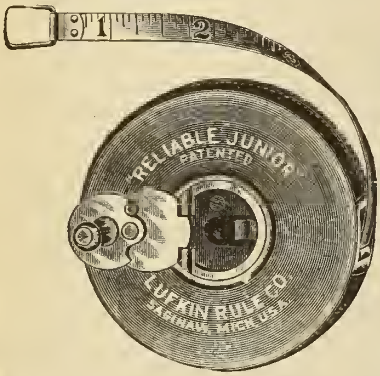

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IF YOU KNOW

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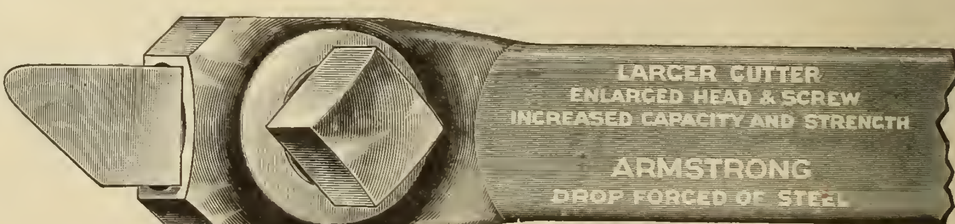

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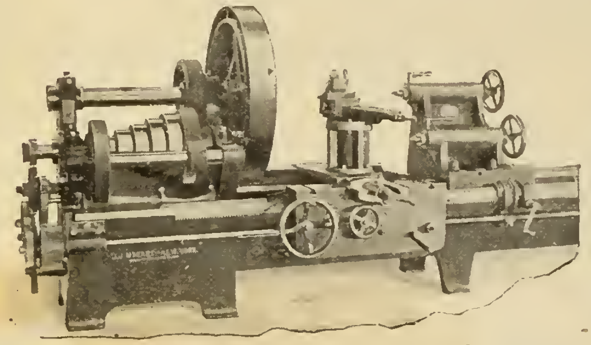
It's a new story about the latest and most up-to-date machinery, told ih a new publication. We wish to advise every buyer of machinery and machine shop supplies in Canada that we represent the leading and largest manufacturers of Machine Tools in America, as per list below, and we carry a large stock of modern machine tools at each of our warehouses. Our facilities for making prompt deliveries are enhanced by our being able to sell from our own stock and also from the stock of our various branch houses.



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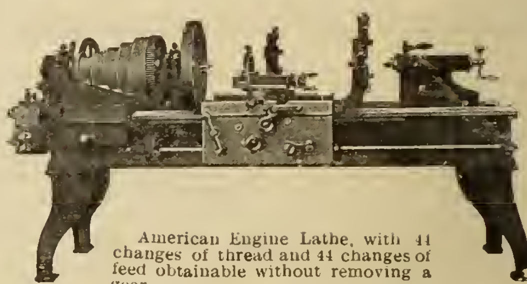
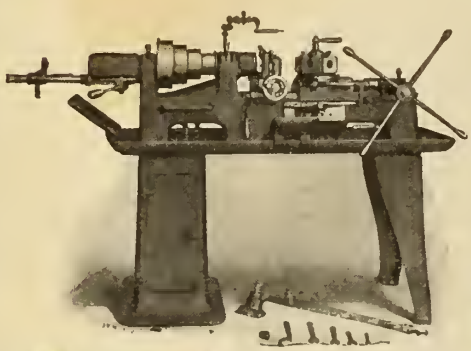
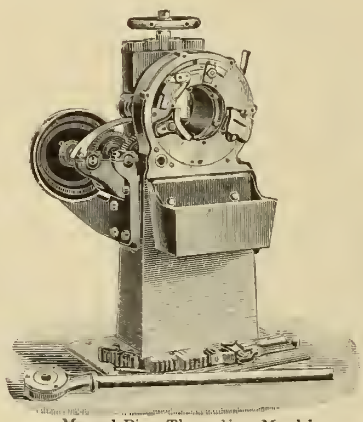


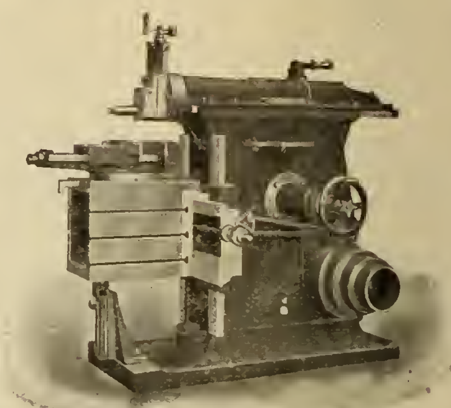
American Engine Lathe, with 44 changes of thread and 44 changes of feed obtainable without removing a gear.



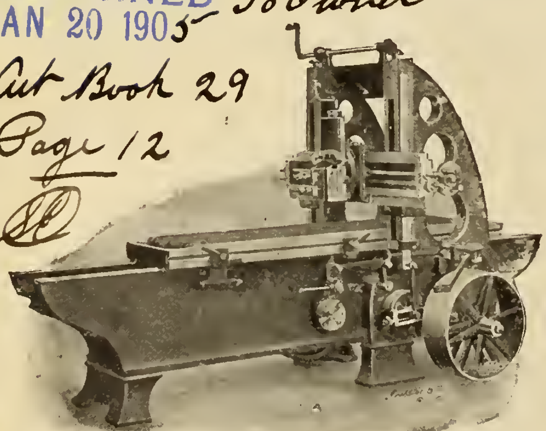
Pratt & Whitney New Model Turret Lathe, 1½ x 18 in.



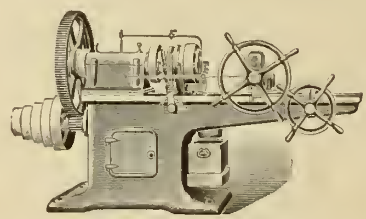
Merrel Pipe-Threading Machine



American Tool Works 16 in. Shaper, with extension base



Pond 30 in. Planer, built with one, two, three or four heads



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We respectfully solicit enquiries for Machine Tools of every description. Information gladly furnished to intending purchasers.

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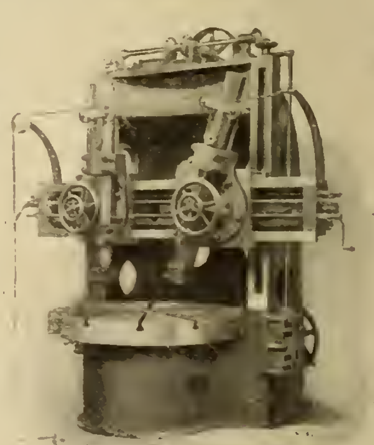


Niles 51 in. Boring Mill

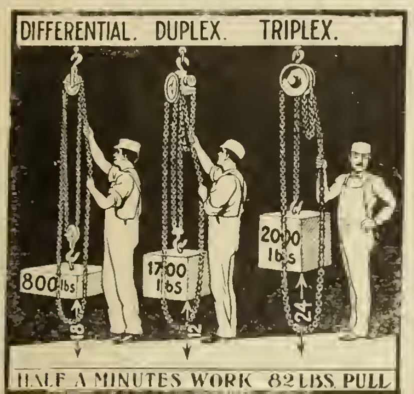
THE FAIRBANKS COMPANY — MONTREAL, TORONTO, VANCOUVER, WINNIPEG

THE FAIRBANKS COMPANY

SMALL TOOL DEPARTMENT

Below we illustrate a few of the lines we carry in stock. We believe we carry the largest stock of machine shop supplies and small tools in Canada, and our shipping facilities are unexcelled.

YALE & TOWNE Chain Blocks



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We are Canadian Sales Agents for

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- Pratt & Whitney Co.
- McCroskey Mfg. Co. (Adjustable Reamers.)
- West Haven Mfg. Co. (Hack Saw Blades.)
- New Process Twist Drill Co.
- Hill Tool Co. (Small Tools and Holders.)
- J. H. Williams (Drop Forgings.)
- Norton Emery Wheel Co.
- Champion Forge & Blower Co.
- Union Chuck Co.
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- Wiley & Russell Mfg. Co.
- Emmert Vise Co.
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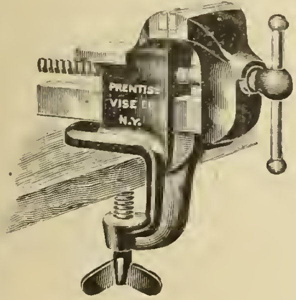

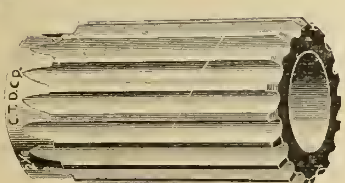

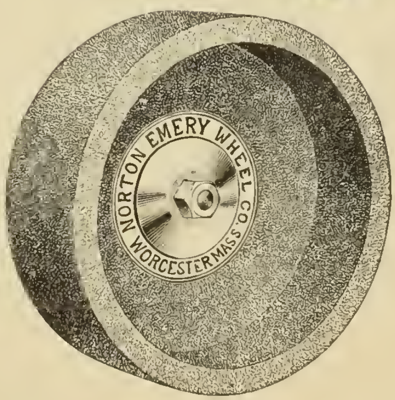

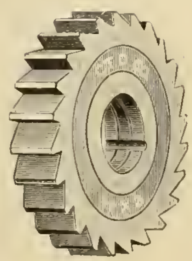

Catalogs of any of the above lines will be mailed upon request. Mail orders filled the same day as received.

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Montreal Toronto Vancouver Winnipeg

Modern Canadian Manufacturing Plants

ARTICLE 1.—The Allis-Chalmers-Bullock Works, Rockfield, Que.

RECENT years have seen an industrial awakening in Canada such as probably no other country in the world has yet witnessed in the same length of time, a notable feature of which has been the establishment in this country of branches of large concerns already operating successfully across the border. Not a few have already commenced manufacturing, and many others have under consideration the establishment of a Canadian factory at an early date. Typical amongst those in operation, and representative of companies of world-wide reputation, is the Allis-Chalmers-Bullock Co., Limited, which was organized about six months ago. The company consists of Geo. Bullock, president; Edgar McDougall, first vice-president; R. W. Chapin, second vice-president and general manager; A. F. Cayford, secretary-treasurer, with the following in addition as directors: James W. Pyke, Col. Henshaw, W. C. McIntyre, Phelps Johnston, Alex. Pringle, H. J. Fuller, J. S. Neave, W. H. Whiteside, Benj. J. Warren, W. W. Nicholls, Edward D. Adams and W. J. Chalmers, names for the most part already well-known in the industrial and financial world.

With the announcement of the formation of this company few realize the industrial importance of a concern in a position to supply almost any machinery for motive power, whether steam, electricity, water, gas or compressed air, taking over as it did the business and representation in Canada of the Bullock Electric Mfg. Co., the Allis-Chalmers Co., the Ingersoll Sergeant Drill Co., the Ledgerwood Mfg. Co., and the Wagner Electric Mfg. Co. Thus in one Canadian industry is embodied all the resources of invention and mechanical achievement developed by a host of skilled engineers in the employ of the above mentioned firms during the past, and whose further improvements the Allis-Chalmers-Bullock Co. are in a position to adopt.

Plant.

When this company was formed the Canadian Bullock Co. had under erection, and well towards completion, a plant for the manufacture of electrical machinery and apparatus, which was taken over and important additions made. The situation is an ideal one, as the property acquired, consisting of about 20 acres at Rockfield, adjoins the Lachine Canal and the main road between Montreal and Lachine, at a few miles distant from the former. Canadian Pacific and Grand Trunk sidings

Allis-Chalmers-Bullock Works—Machine Shop.

enter the grounds and some of the buildings, giving all the transportation facilities that could be desired. The general scheme of the buildings is such as admits of additions in either direction at any time, and it is already proposed to nearly double the length of the present machine shop. There are five main buildings, namely: a machine shop, blacksmiths' shop, pattern shop, foundry and power testing and wiring building. They are all of the most modern type, being brick enclosed structural steel buildings on stone and cement foundations, and having stone and cement piers. They have composition roofs with double skylights and numerous wide windows, making them bright and cheerful.

The buildings are all heated by the Sturtevant system of hot air from a central heating plant in the power house, the heat being conveyed in metal pipes connecting with each. Steam is also carried to the machine shop, pattern shop and smithy to run the steam engines, and for the steam hammers in the latter. This power system is to be superseded as soon as the transformation can be made, and electric power used altogether in the different buildings.

A narrow gauge industrial railway is in operation in the machine shop, testing and wiring shop, foundry and blacksmiths' shop, and running from one to the other, supplementing the cranes and reducing the labor of transportation to a minimum.

A splendid fire protection system is in operation. The water is procured from the canal adjoining, and from a fire underwriters' pump, with a capacity of one thousand gallons per minute, mains are led to the different buildings. There are dry fire extinguishers in each department as well, reducing any danger of fire to a narrow margin.

The works are in charge of C. W. Johnston, as superintendent, who has had a wide experience, and who is at present inaugurating further improvements to the plant.

Machine Shop.

The machine shop, of which an interior view is given, in addition to the details of construction already mentioned in connection with all the buildings, is provided with cement flooring, ensuring a solid foundation for the heavy machinery installed. It is 400 ft. long by 100 ft. in width, and 35 ft. high. A 20-ton Northern Electric traveling crane, with a span of 42 ft., runs the entire length. As will be seen from the illustration, the general arrangement is of the most approved design and affords ample light for all operations. Artificial light is supplied by rows of enclosed arc lamps on either side, supplemented by incandescent. The centre aisle is devoted to assembling some of the heavier machinery, while at the sides are installed all other machines. Room has been allowed for superintendent's and foreman's office, time-keepers' and shippers' office, storeroom, toolroom, winding department and engineers' and draughting offices.

The power is derived from a Robb-Armstrong engine, which runs the shafting on one side and likewise a fifty k. w. generator. The latter supplies power for shafting on the other side, which is driven by a 35 h. p. motor. Compressed air mains run throughout the shop to operate pneumatic hammers, chisels and chippers. A recent addition to the equipment is a 12-foot Niles self-driven boring mill, operated by the Bullock multiple-voltage system of control. In addition to this there are nearly one hundred machine tools, embodying the latest in duplex and horizontal boring machines, double headed planers, slotting machines, universal milling machinery drill grinders, radial and other power drills, boring and turning mills, threading machines and a large number of lathes, including turrets and hollow spindle with centering machines and valve grinders.

Blacksmiths' Shop.

This shop is 100 ft. by 80 ft., and 30 ft. high, with iron clad wood enclosed composition roof, and has two wood frame additions. It is equipped with forges and Bertram steam power hammers. A Sturtevant fan motor, driven by a vertical engine, supplies the draughts for the forges. Two three-ton jib cranes, with 15 ft. swing, traveling on single tracks, are used for heavy work.

Pattern Shop.

Just south of the smithy is the pattern shop, which is 180 ft. long, 60 ft. in width and 20 ft. high, built after the same style as the others, but with wood flooring. The power for the pattern shop is developed by a 25 h. p. Ames steam engine run by steam supplied from the central station. This shop is fitted with band saws, pattern-makers' lathes, buzz planers, rip and cross-cut saw tables, etc. The building is divided by a brick fire partition with fire-proof doors, making a pattern storeroom in which the many patterns in use by the company are placed, as shown in the illustration.

Foundry.

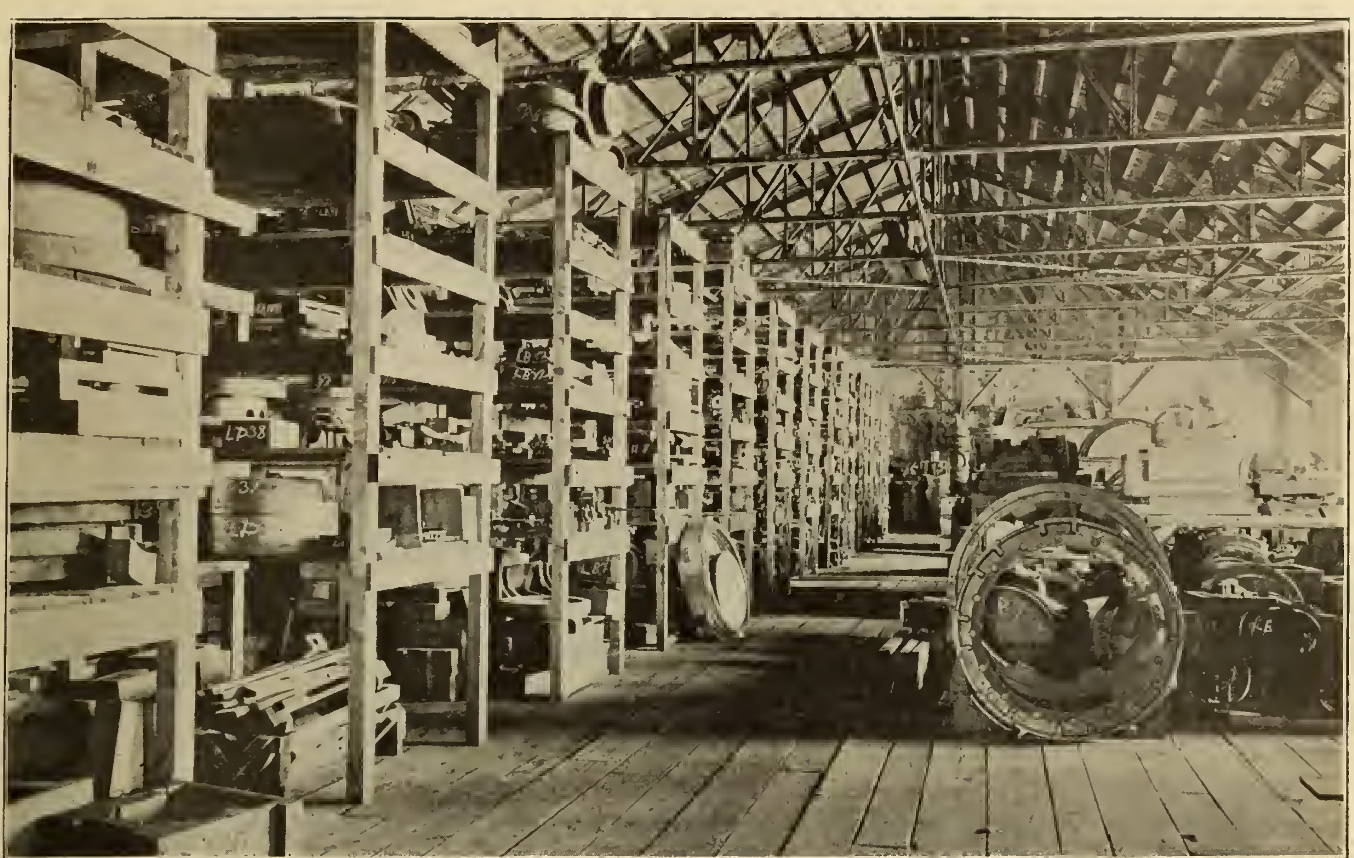
The foundry is equipped with every facility for the rapid turning out of castings from several tons in weight down to the smallest required. This building has a floor area of 20,000 square feet, and is 35 ft. in height. It is of the same construction as the others with a frame addition for storing castings. A 20-ton electric traveling crane facilitates casting operations greatly. A five-ton auxiliary crane is also used. The cupola is a number six Whiting Foundry Co., connected with a number eight Sturtevant fan run by a 33 h. p. motor. A pneumatic elevator carries the cupola charge to the upper platform. A cast is run off daily, in which about ten tons of metal are used. Six and two-and-a-half-ton ladles catch the molten metal, which are then conveyed by means of the traveling crane. For the larger castings, such as frames of generators, two large floor pits have been prepared, one 18 by 14 ft., and 3 ft. deep, and the other slightly smaller. Core ovens, two in number, have been built, and these are in operation almost continuously. Owing to the smoky nature of the atmosphere in this building, it was impossible to get a clear illustration.

Power Testing and Wiring Building.

Although under one roof, and surrounded by a continuous wall, there are here three distinct divisions, separated by fire walls and metal doors, one for the boilers, one for the power house, and the other for the electrical department. The building is 300 ft. by 100 ft. and 27 ft. high, with brick enclosed cement flooring. In the boiler room are two return tubular steel boilers of 100 h. p., and a Babcock & Wilcox 200 h. p., together with a 200 h. p. Laurie heater. These supply the heat for all the buildings as well as the steam for power. Soft coal is used and natural draught is afforded by a circular chimney, built of fire brick 140 ft. high.

To comply with the underwriters' rules for fire protection is an 18x10 fire pump. Set up in the power room is a complete Sturtevant heating system, mentioned before. It consists of two 170 housing fans direct connected to 10x12 horizontal engines, and two 11 section heaters with 80 nine-foot pipes in each section. Two duplex compound air compressors supply the power for the pneumatic tools, hoists, etc. A Robb-Armstrong 12x12 high-speed steam engine drives a 59 k. w. direct connected Bullock generator, which supplies the electric light and power for testing electrical machinery and for running the electrical cranes.

In view of the change whereby electrical power is to be used in the different departments, and for individual machine drive, as well, a 300 h. p. Goldie & McCulloch Ideal high-speed engine direct connected to a 200 k. w., 250



Allis-Chalmers-Bullock Works—Pattern Room.

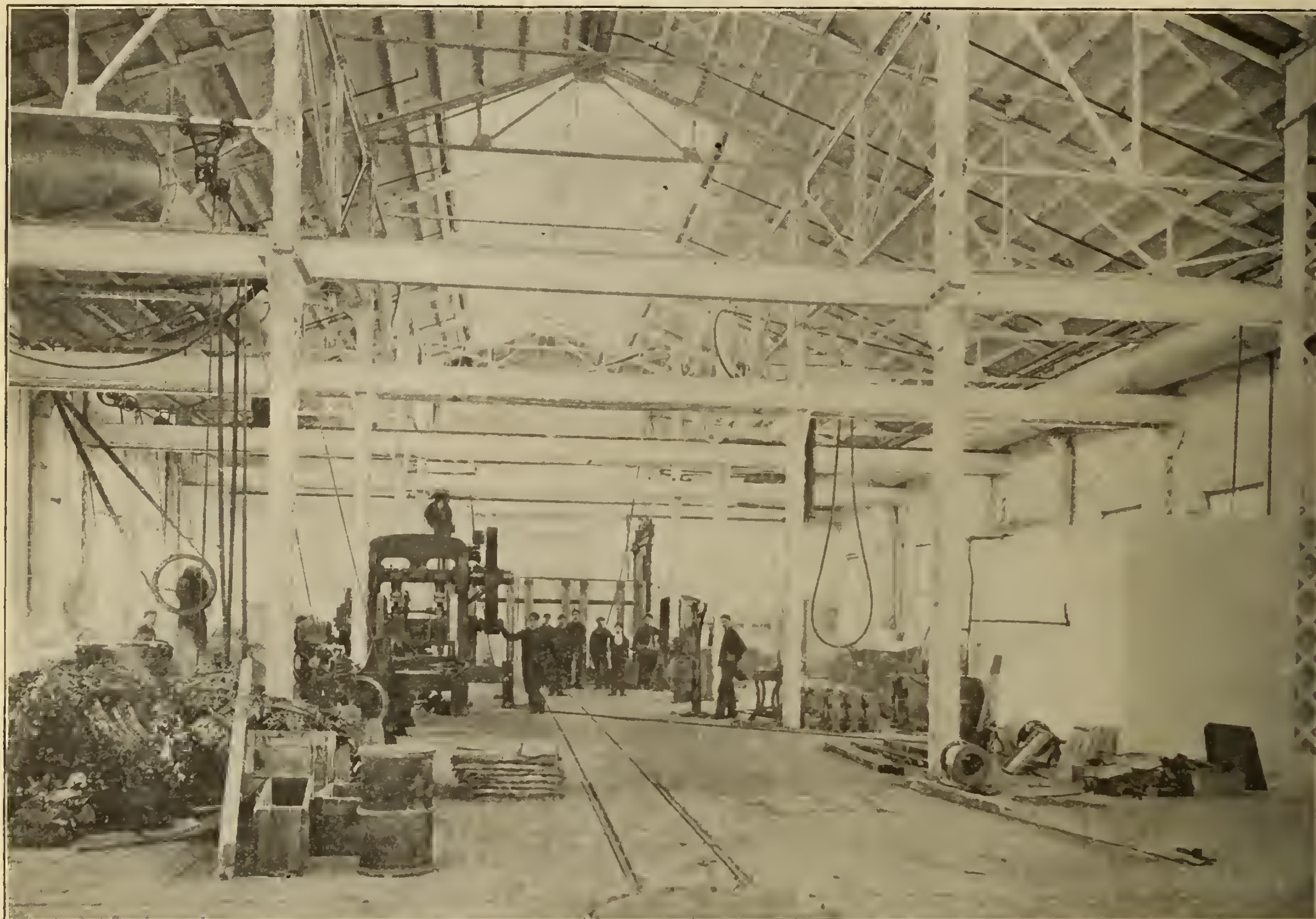
Allis-Chalmers-Bullock Works—Foundry.

volt direct current Bullock generator is being installed.

Separated from these by a brick wall, as mentioned, is the electrical department, of which at present one part only is in operation. Within a few weeks, however, the testing, winding and engineering departments will be established in this building. The engineering department is in charge of H. A. Burson, M. Sc., who has made a specialty of induction motor design, and is at present developing several new lines. The annealing department is operating, and motor-driven punching and shearing machines are turning out a large quantity of work. The annealing oven is built against the wall dividing the power room. It has three grates. The oven gates are lifted by pneumatic power and the carriage upon which the metal to be annealed is placed rolls on ten inch balls set in tracks. A notable feature in connection with the oven is a pyrometer that enables the temperature to be read electrically at considerable distance from the oven. It might be mentioned that this pyrometer is the invention of Dr. Barnes and Dr. Tory, of the science faculty of McGill University, and measures the heat of the oven at any time within five degrees in eight hundred.

Manufacturing.

The manufacturing powers of this company are enormous, acquiring as it did the rights of the large and long established companies in the United States in all their branches. A mere list of the lines will give some idea of its breadth and scope. From the Bullock Electrical Mfg. Co. they are able to supply direct current machinery, alternating current machinery, including induction motors from one half to 750 h. p., railway equipments, and arc lamps. Through the Ingersoll Sergeant Drill Co., rock drills, air compressors, coal cutters, stone channeling machines, pneumatic hammers, rivetters, chippers, metal drills, pile drivers, quarry bars, stone chippers and dressers, air-lift pumps and ticket cancelling boxes. Through the Ledgerwood Mfg. Co., hoisting engines, cableways, log hauling machinery, hoisting and conveying apparatus and ballast unloaders. Through the Allis-Chalmers Co., Corliss engines, piston and centrifugal pumps, water and steam turbines, hoisting engines, blowing engines, turbo blowers, ore crushers, roasting and smelting machinery, ore milling machinery, concentrating machinery, conveyers, mining and ore cars, perforated metals, crushing rolls, ore stamps, cyanide, clorination, and lixivation machinery, cement and rock breaking machinery, wire cloth, boilers, machinery for stamping or classification, saw mill machinery, gas engines, brick and bricketing machinery, sugar machinery, flour-mill machinery, and a general line of shafting, pulleys, tightners, fans, etc., for the transmission of power. Through the Wagner Electric Mfg. Co., switch-board instruments, single phase motors and transformers.



Allis-Chalmers-Bullock Works—Annealing and Punching Department, Electrical Building.

On the floor of the machine shop was noted a large amount of pneumatic and electrical machinery in course of erection. Among these were two 800 k.w. rotary converters for installation at Shawinigan, together with 900 k. w. three-phase transformers to go with them. There was also a complete electrical installation in course of construction for the Town of Lethbridge. Some of the largest installations in Canada

have been done by this company, including a 1,000 k. w. generator installed at Sheik's Island power house, near Cornwall. A 1,000 k. w. generator for the Canadian Electric Light Co. of Quebec; a 750 k. w. for St. Francis Hydraulic Co.; a 1,000 k. w. for the Sudbury Power Co.; and an 800 k. w. for the Winnipeg Street Railway. The two largest induction motors at present in operation in this country are Bullock machines.

While the Allis-Chalmers-Bullock Co. are little more than well settled in their new works, they have already commenced operations on a scale, and with prospects, that mark them as one of the coming great manufacturing concerns of the Dominion of Canada.

A LARGE MACHINERY REQUIREMENT.

When it was intimated that the Canada Car Co. was to build a plant to cost over a million dollars, and to employ one thousand men, it was equally well known in machinery circles that a very large amount of machine tools and accessories would be needed. It was only recently that the actual requirement has been decided and the list following was given to Machinery and Manufacturing News by W. P. Coleman, the president of the company:

Machine Shop.

One 36-inch by 17.foot engine lathe, 10 feet between centres; one 24-inch by 10-foot turret lathe, one 36x36 inch by 10-foot planer, one No. 4 Universal milling machine, one 18-inch by 10-foot engine lathe, taper attachment; one 36-inch boring mill; one 66-inch radial drill press, one 18-inch slotter, one 24-inch shaper, one 32-inch drill press, one six-spindle nut tapper, geared; one wet tool grinder, 34-inch stone; one double stand emery wheel, six 6-inch bulldog vises, miscellaneous tools, shafting, hangers, couplings, etc.; belting and lacing, one 40 horsepower three-phase induction motor.

Forge and Smith Shops.

One 7½-ton traveling crane, one 2000-pound double frame steam hammer, one 1500, one 800 and one 600 pound steam drop hammer; one 300-pound single frame steam hammer, one 100 and two 80-pound helve hammers, one 1½, two 2½ and one 4-inch forging machines; three 1½-inch bolt headers, one brake lever rolls, one 2½-inch bar shear, guillotine frame; one single head punch or shear, throat 22 inches; one double head punch and shear, throat 18 inches; one single head punch or shear, throat 15 inches; one double head punch and shear, throat 16 inches; one horizontal punch, throat depth 12 inches; one four-spindle brake lever multiple drill; one 2-inch eye bolt bender, one bolt pointer, ½ to 2 inch bolts; one ten-spindle multiple drill for brake pins and bolts, 7-16-inch holes; one 2½-inch double head threading machine, two 1½-inch double head threading machines, two 24-inch and one 36-inch Aurora drill presses, one single milling machine for key ways No. 1, one power bulldozer, capable of bending arch bars and yokes; one small bulldozer, 24-inch stroke; two air tables, two steel pressure blowers, two six-spindle arch bar drills, one large furnace, stack 30 inches by 60 feet, for 2000-pound hammer; one large furnace for arch bars, 18 small heating furnaces, one chain making equipment, consisting of one winder and cutter, five foot hammers and furnaces; three blacksmith forges, three anvils, miscellaneous tools, steam piping, valves, tracks, tie spikes, shafting, hangers, couplings, pulleys, belting and lacing, etc.

Truck and Bolster, Wheel and Axle Shops.

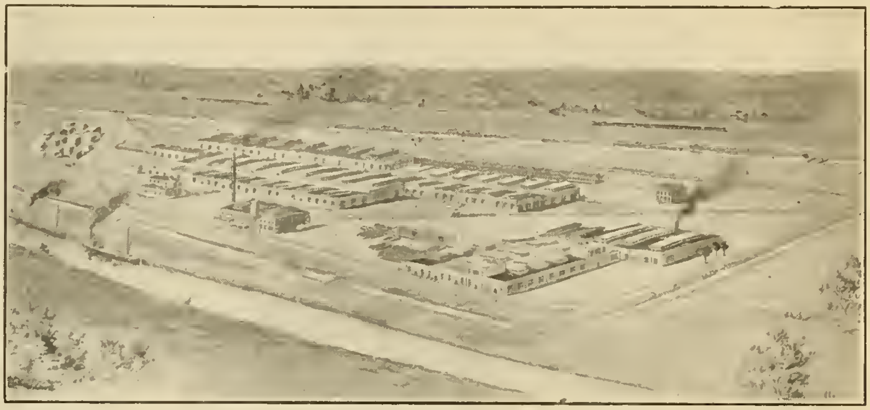
Ten pneumatic rivet hammers, three pneumatic reamers, six double head axle lathes, No. 3; four 48-inch boring mills, one No. 2 hydrostatic wheel press, one double stand emery grinder, 16-inch wheels; two rivet furnaces, miscellaneous tools, shafting, hangers, couplings, pulleys, belting and lacing, hoists; one 75 horsepower three-phase induction motor.

Pipe and Air Brake Shops.

One power pipe cutter for 8-inch pipe, two No. 2A pipe vises, ⅛ to 4-inches; one six-inch Prentiss vise, one large cutter, stock and dies, 1 to 3 inch pipe; one small cutter, stock and dies, ⅛ to 1½ inch pipe; one pneumatic pipe bending machine, two power pipe threading machines, ¼ to 2 inch; miscellaneous tools, shafting, hangers, pulleys, belting and lacing; one 7½ horsepower three-phase induction motor.

Planing Mill.

One 7½-ton electric traveling crane, two timber planers, 20x14 inches thick, one planer and matcher, 16-inch; two planers and matchers, 10-inch; three swing saws, 18 inches 7 feet drop of frame; two swing saws, 24 inches drop of frame; one 32-inch cut off saw, automatic, 30-inch stroke; one sliding spindle, double cut off saw, 12-foot bed, 24-inch saw; one brace cut off saw, one 36-inch cut off saw, 32-inch stroke; one outside molding machine, 12-inch; one self feed rip saw, 36-inch saws; two self feed rip saws, 70x45 inch table; one heavy end tenoner, 30-inch saws; one heavy car tenoner, single with saw; one light car tenoner, one vertical sill tenoner, two horizontal boring machines, four-spindle; two vertical boring machines, six-spindle; one vertical single spindle boring machine, two horizontal mortisers, single hollow chisel; one gainer, No. 3 combination, with vertical mortiser, 40-foot travel table; one universal wood worker, without boring table; one 36-inch band saw, 20-foot saw; one extra heavy double spindle shaper, one saw filer, automatic cut-off for circular saws; one band saw setting and filing machine, one automatic 32-inch knife grinder, one emery wheel stand, 10-inch wheel; one six-inch vise.



New Works of Canada Car Co., Montreal.

Pattern and Carpenter Shops.

One 36-inch band saw, 20-foot saw; one 18-inch rip saw, hand feed; one pony planer, 24x6 inches thick; one jointer, 24-inch head; one hand lathe, 20 inches by 9 feet long; one single head boring machine, one trimmer, one grindstone, six benches and vises, one double emery grinder, "Blount;" miscellaneous tools, shafting, hangers, couplings and pulleys; belting and lacing; one 15 horsepower three-phase induction motor.

Passenger Car Shops.

One 7½ ton electric crane, one Daniels planer, 24 inches wide, 18 feet long; one Whitney scraper, 42 inches wide; one pony planer 36 inches by 6 inches thick; one Berlin invincible sander, 36-inch; one

relisher, one jig saw, one sash sticker, one 8-inch sticker, one universal wood worker, with boring and routing table; one trim saw, double; one light sash tenoner, one Boults combination shaper, edge and surface molder, with scroll molding and gear carving attachments; one light hollow chisel mortiser, one light rip saw, one band saw, with resawing attachments; one light single spindle vertical boring machine, one turning lathe, 10 inches by 9 feet, iron bed; one self-feed rip saw, one embossing machine, two veneer presses, ten benches and vises, miscellaneous tools, shafting, hangers, couplings and pulleys; belting and lacing.

Power Plant—Boiler Room.

Six 300 horsepower water tube boilers in three batteries, 150 pounds pressure, equipped for hand firing; one breeching, steel plate behind boilers to stack, above ground; two 12x7x10 inch outside packed duplex plunger, boiler feed pumps; two 10x16x12x18 inch duplex packed piston, water supply pumps; two feed water heaters, 1000 horsepower each; one steel stand pipe, 12 feet diameter, 55 feet high; piping from canal to pump, 10-inch cast iron; pump to stand pipe, 8-inch wrought iron.

Engine Room.

Two 500-k.w. turbines, 1600 revolutions per minute; one surface condenser, one centrifugal pump, with motor; one vertical air pump, with motor; one 25-k.w. turbo-exciter set, one 30-k.w. motor exciter set, one switchboard, one 10-ton hand traveling crane, two air compressors, capacity 1,500 cubic feet each.

TESTING MACHINES.

DEVELOPMENT of testing machines has been carried on largely by J. H. Wicksteed, president Institute Mechanical Engineers, and a machine recently built by him together with historical references is described in the paper read before the institute. It will test a strut 88 feet long by 3 feet 3 inches by 3 feet 3 inches, or a chain cable 13 fathoms long of 4 1-2 inches diameter iron, and it will test a beam 3 feet 3 inches broad, 6 feet 8 inches deep, by 20 feet between supports. It has also carried shearing tests further than hitherto. It will test in single shear a bar 8 inches wide by 2 1-2 inches thick. Machines of comparatively small dimensions suffice for testing specimens of the material of which struts, links, girders, and arches are made, but when you wish to test the struts, etc., themselves, which form bridge members, or members of any construction, the machine must be large and powerful; and to do this work economically the machine must be so designed that testing long or short pieces in any of the different senses can be accomplished without any change of appliances which involves labor and delay. The very reason for testing by machinery is to save time and labor and expense. Think what the expense would be to load a girder with 300 tons of deadweight! The weights themselves, and supports for the girder, would cost about £2,400. The loading and unloading of the weights would make each experiment cost a hundred times as much as if it were made on the machine to be described. A testing machine measures the load which is applied to a specimen instead of actually loading the specimen with dead weights, and in proportion as the loads are large, the saving between direct loading and measuring the load by a machine becomes large also. The most primitive form of machine is to have the specimen anchored to a foundation at one end and pulled at the other end by the short end of a lever with scale pan for weights at its long end, but there is as much difference in convenience and economy between such a machine and the most highly developed form of machine as there was between the use of a lever and the simple use of direct loads. The next step in the development of testing machines was to apply tractive force to the end of the specimen, which had previously been anchored, and measure this tractive force by lever and scale pan as before. The earliest machines of this kind were made after the introduction of chain cables for ships, which took place in 1813, and when these had become largely adopted in place of hemp cables by the Admiralty a machine was made for the Royal Woolwich Dockyard by Bramah, of Pimlico. The machine had a hydraulic cylinder at one end to put the pull on the chain, and levers with small weights at the other end to measure the amount of the pull. It was on this machine that Prof. Barlow made his experiments on the strength of materials, but neither the machine of 1813 nor the machine of 1832 was adapted for testing struts, and for anything else but chains they must have been extremely inconvenient. The introduction of steel for ship-building in 1875 led to a very large amount of testing plate strips in machines of about 50 tons power. These machines have been made so convenient for the special purpose, that a specimen of steel plate can be accurately tested for strength and extension every minute; in other words, sixty tests an hour is not unusually quick.

WHERE THE FIRST TELEPHONE WAS MADE.

ON a pine clad eminence about a mile and a half from the city of Brantford, stands a house whose historic interest will grow with the growth of Canada's trade. It is the house in which was invented by Prof. Bell the first telephone.

In these days of universal telephones it is not easy for us to realize that it is little more than a generation since that great and marvellous invention was introduced to the public. It would perhaps be an exaggeration to say that it has revolutionized commerce, but it is not going too far to say that by facilitating commercial intercourse to an extent undreamt of by an earlier generation it has given an impetus to trade hardly less than that caused by the introduction of the telegraph.

The house in question was built by a Mr. Morton, whose grandson, Mr. Foster, conducts at the present day a flourishing grocery business in Brantford. The house was later acquired by Mr. Bell. It was from the foregoing historic circumstances that the city of Brantford derives its familiar appellation of "The Telephone City." One is glad to learn that the civic fathers of Brantford have ideas of acquiring the house and preserving it as a national monument.

FIRST AMERICAN IRON WORKS.

THE first iron works to be built in America were erected by the London Company, of London, Eng., in 1619, near Richmond, Virginia. The cost of constructing the furnaces and opening the mines amounted to $200,000, which, for three years produced a good quality of iron. The name of the village which sprung up in the vicinity of the works was Warwick, in remembrance of Warwickshire, the district from which many of the workmen emigrated. Before the mines were successfully operated iron was manufactured from a bog ore gathered from the meadows in the neighborhood of the creek. All went well until one day in March, 1622, the Indians under Opitchapan, surprised the village and murdered all the inhabitants with the exception of a boy and girl who hid in the woods outside of the village.

The Use and Abuse of Steam Boilers.

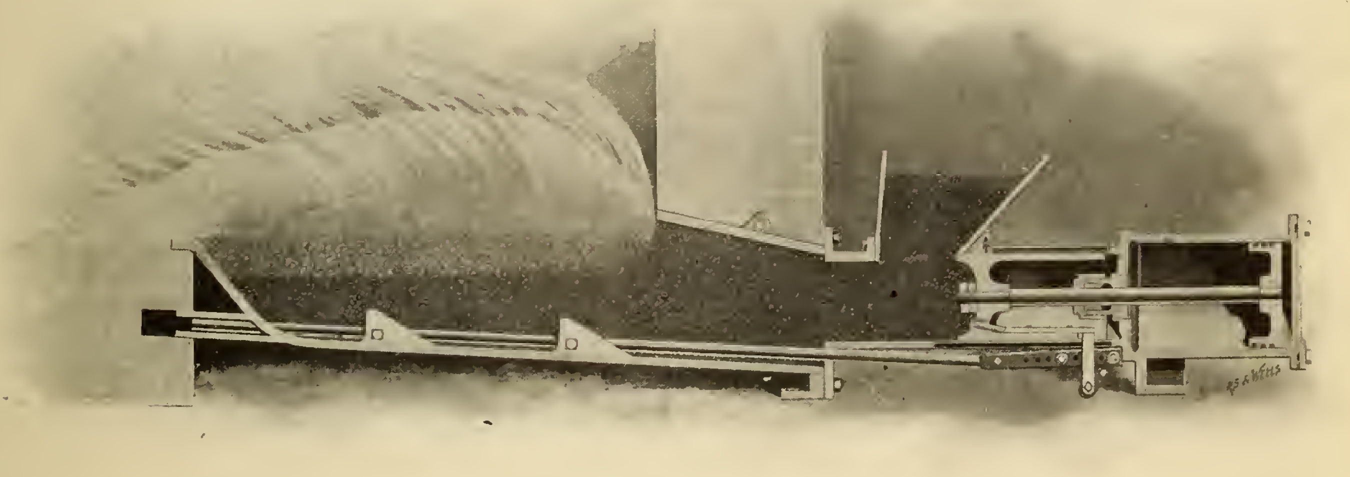
THE first types of boilers used for the generation of steam for mechanical purposes were spherical, and were heated wholly from the outside. With the progress time has brought, and the improvements resulting from years of study and application to the subject, a revolution in the design and efficiency of steam boilers has taken place. The form and construction depend greatly upon the purpose for which they are to be used. They may be divided into six classes, as follows: Plain cylinder boilers, flue boilers, which include the Cornish types, single flue, Lancashire type, two flues, and the Galloway type, breeches flue; multitubular or fire tube boilers, including cylindrical tubular, locomotive and marine boilers; water tube or sectional tube boilers; coil boiler, including the torpedo boat, and other types, and the vertical boiler, which is usually a modified form of some type of the horizontal, but the two main types may be classed as water tube and fire tube. The former is most commonly used in factories and manufactories in Canada, and the internally fired direct and the plain horizontal tubular, are fire tube marine, the locomtoive type.

Thermal Storage.

Opposed to the method of quick steaming boilers, which have been so universally adopted, is the system called thermal storage. This consists in using boilers having only a capacity sufficient for the average load, these being run continuously day and night. At time of light load the steam is admitted through pipes to large iron reservoirs of cheap construction, in which it heats a large quantity of water to a high temperature. When the heavy load comes on steam is drawn from these reservoirs.

Efficiency.

The main object in the design of a steam boiler is to provide as large amount of surface as possible, with hot gas on one side and fire on the other. For any given boiler there is a certain rate of combustion, at which it gives its best results, and that result does not vary greatly with different makes of leading styles. They give an efficiency of 65 per cent. to 70 per cent. By efficiency is meant the ratio of the amount of heat given to the boiler to what could be developed if all coal were completely burnt, and all heat utilized. A compromise must be made between the thickness of boiler plate and safety. The thicker the plate the less heat received by the boiler, and therefore the less its efficiency, but the greater the safety and the higher the pressure it will stand. It is not convenient to rate a boiler by horse-power, but by the amount of steam generated, and the amount equivalent to a horse-power is considered as 30 lbs. per hour. As the efficiency or inefficiency depends on the manner in which the heat is distributed, it may be interesting to note what becomes of the heat generated, and what constitutes the losses. Seventy per cent. of the gases go towards heating and evaporating the water, and by using economisers the efficiency may be increased 4 per cent. to 6 per cent. Considerable heat is wasted by warming up the furnace gases, the air entering at a low temperature and leaving it at a high. About 16 per cent. of the total heat developed by the consumption of coal thus goes up the chimney. A further portion of heat is used in evaporating the moisture in the coil. Heat is lost by radiation. When a grate is cleaned hot clinkers are taken out, making further losses. Losses due to imperfect combustion of coal amount to 1 per cent., and unaccounted losses to about 5 per cent.

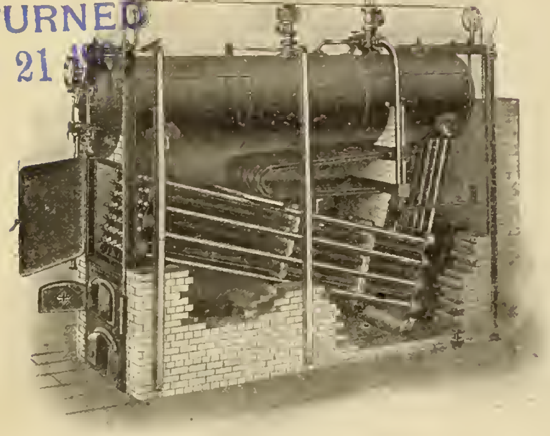


Jones' underfeed mechanical stoker.

Durability.

Corrosion is the most damaging thing that happens to a boiler, whether internal or external, and should be carefully guarded against. That, with the formation of scale, forms the two great causes of trouble in boilers. The composition of the feed-water is all important, and this should be analyzed frequently. In marine boilers there is no trouble from this source, as surface condensers are used. If the water contains magnesium chloride, at high temperature it is decomposed into magnesium and free hydrochloric acid, which attacks the metal. If calcium carbonate and magnesium chloride are both present they unite and form carbonic acid, which is very injurious. The remedy for this is to make the water alkaline by putting in washing soda to neutralize the acid. Again, air is sometimes deposited on the inside, and causes the

metal to become pitted. It should be seen to that the feed pump is working properly, and is pumping water only, and no air with it. Sometimes a film of oil is deposited on a part of the heating surface of the boiler, and being a bad conductor the metal cannot be cooled so easily at this point, and the pipe or plates are apt to become overheated and warped. To overcome this, the water may be filtered through a blanket or coarse Turkish towel, or it may be allowed to stand in a tank until the oil collects at the surface, when it may be removed. Formerly animal and vegetable oils were used, and they were very injurious, as they were decomposed into fatty acids and iron stearate, but now the oils used are mostly mineral, and this trouble is not frequent. Galvanic action also causes corrosion. To prevent this zinc slabs are placed on the inside, and the zinc is eaten away and not the metal of the boiler. Rust on

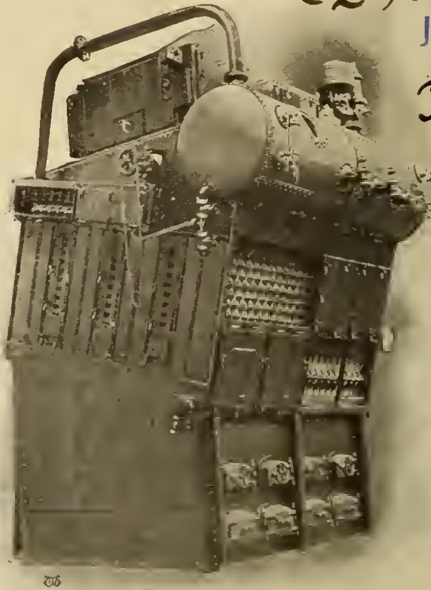


Latest type of Babcock & Wilcox water tube steam boiler, fitted with superheater.

the outside very often occurs, and the main cause of this is dampness, either due to wet ashes being allowed to rest next the metal of the boiler, which eat it away very rapidly, or to a leaking valve, which causes a drip and wets a certain place, immediately starting it to rust. The remedy for this is to keep all joints and valves water-tight. In brief, three things should be particularly noticed in keeping a boiler from deteriorating. They are the purification of the feed water, having the water slightly alkaline, and keeping the boiler clean. If a boiler is not in use, it should be empty and perfectly dry, which condition may be maintained by having the boiler closed tightly and a quantity of quick lime inside, or by having it full and free of air, which may be done by heating slowly to drive off the air, and then closing perfectly tight.

Management.

The main object of the boiler attendant should be to maintain a steady pressure of steam, combined with a uniform level at the gauge glass. One of the worst things a boiler suffers from, due to mismanagement, is a strain from unequal expansion. If any part of a boiler is heated to a higher temperature than another, the hotter part will expand more. This unequal expansion sets up enormous stresses, and if it were not for the fact that the metal is elastic rupture would take place. This is due to bad circulation, aggravated by forcing the boiler when first raising steam. If possible in raising steam, the boiler should always be given time. In making note of the water level, the glass gauges should not be relied upon entirely, but the gauge cocks should be tried, because the passages in glass gauges are apt to become clogged and give a false indication of the height of the water, which might be lower or higher than in the glass tube. The pressure gauge is another very important fitting that requires careful attention. It should be absolutely accurate, and if there is the slightest doubt about it, it should be compared with the standard gauge. The pointer should read zero at no pressure, and should not press against the stop pin at that mark. The safety valves should be kept in order, and should be tried at least once every day to see that they act freely. The feed check valve, or clack valves, when they can be regulated, should be so adjusted that the amount of feed is as regular and uniform as possible. The opening of the steam stop valve is something that does not always receive proper attention. The valve should be open the slightest degree after all drain cocks are open and free. When steam and water issues from the drain cock the valve may be opened a little more, and not until steam alone is coming from the cock should the valve be opened to its full extent. A valve should never be closed tightly when the boiler is cold, since on warming up it may be impossible to open it. In case the water level falls too low in the boiler, the fire should be immediately covered with ashes, wet if



Babcock & Wilcox patent water tube, main boiler.

possible, or earth, if nothing else is handy. Fresh coal may be used, great care being taken, however, to put on a sufficient amount to deaden, and not to increase the fire. The fire should be drawn as soon as it is possible to do so, without increasing the heat. The feed water should not be turned on, the engine started or stopped, or the safety valve lifted until the fires are out and the boiler cooled down.

In the firing of a boiler the prevention of smoke is worthy of consideration, and one of the best ways is to use coal that is not liable to its production, combined with proper firing. The condition most favorable to the production of smoke is the placing on the fire, reduced to a glowing mass, of a large charge of

green coal. The coal immediately gets warm and gives off gas before it is heated enough to burn. These gases are largely hydro-carbons. They decompose and cause smoke, and in passing off mean great loss. Sufficient air should be supplied to allow complete combustion. The air and gas which distils from the coal must be thoroughly mixed, and the temperature should be kept high. When more air is required, if fresh coal is supplied, the resistance is increased and less air can enter from the bottom of the grate, which causes smoke. By forced draught a blast of air may be increased just at the time when more air is needed. Another condition favorable to the formation of smoke is the fact that the gases that are evolved come in contact with comparatively cool surfaces, preventing their ignition. Firing a little coal at a time, and often, is the only way to prevent smoke. Mechanical stokers have been introduced, which are very successful in this respect. These stokers mean economy in firing, as they do away with the services of manual stoking. An illustration is given of a Jones' underfeed mechanical stoker, showing the method of operation.

Inspection.

In inspecting a boiler first go over the outside of the boiler, and the inside of the fire-box before it is clean, and if there is a leak it is shown by a white or reddish stain; then open the boiler and look inside. All scales should be removed, the fire box cleaned, and the boiler washed down inside. One must be on the lookout for any signs of corrosion both inside and outside, and in the case of a doubtful plate a hole should be drilled in it. It is also necessary to be on the lookout for cracks, or pitting, or grooving, this latter being the tendency of the plates to bend slightly at the joints. The action is only microscopic, but the metal subjected to continual slight bending, corrodes and cracks slightly. See if nuts and stays are all right, and see if any plates have bulged at all. See if any previous repairs have been made, and make sure that they are in good order, then give a hydraulic test by pumping water into it. A boiler should be tested to a hundred lbs. or more than working pressure, but this is governed by local by-laws and underwriters' by-laws. Lastly, raise steam and see if safety valves are all right, try blow-off valves, water gauges, feed checks, etc.

Testing.

Tests of steam boilers are made to determine the quantity and quality of steam that they supply, the weight of fuel required to produce a certain amount of steam, and other similar facts. A boiler test requires considerable knowledge, care and skill as well as accurate apparatus. The principal points to be ascertained and noted in a boiler test are: First, the type and dimensions of the boiler, including the area of heating surface, steam and water space, area of water surface and draught area through or between tubes or flues; second, the kind and size of furnace, the area of the grate, with proportion of air spaces in it, type and size of chimneys, length and area of flues; third, kind and quality of fuel, and amount of ash and water therein, this latter being a more important item than is generally understood, as it not only adds to the weight without increasing the value of the fuel, but the heat taken to evaporate and send the steam up the chimney in a highly superheated condition adds to the unobserved waste; fourth, temperatures of external air of fireroom, of chimney gases, of fuel, of water, and of steam; fifth, pressure of steam, of barometer, of draught in chimney; sixth, the weights of feed water, of fuel, and of ashes; seventh, time of starting and of stopping test, taking care that the observed conditions are the same at each as far as possible; eighth, the quality of the steam, whether wet, dry, or superheated. From these data, all the results can be calculated, giving the economy and capacity of the boiler, and the sufficiency or insufficiency of the conditions for obtaining the best results.

The amount of water evaporated per pound of coal is universally conceded to be the proper measure of the efficiency of a boiler, but in order to compare one boiler with another, each should have equally good coal, be fed with water at the same temperature, and furnish steam at the same pressure. As this is impracticable in testing, a standard has been accepted, to which all tests should be brought for comparison. This is called the "equivalent evaporation, from and at 212 degrees" per pound of combustible. That is what the evaporation would have been if the coal had been without ash, the feed water at boiling point, and the steam delivered at atmospheric pressure. It may be determined by the following formula:

Let W = the observed evaporation per lb. of combustible.
t = the observed temperature of feed.
T = the temperature of steam at observed pressure.
H = the total heat of steam at the observed pressure.
W′ = the equivalent evaporation from and at 212 degrees, then

$$W' = W\left(1 + \frac{0.3\,(T - 212) + (212 - t)}{966}\right).$$

$$\text{or, } W' = W \times \left(\frac{H + 32 - t}{968}\right).$$

The value of T and H may be found by reference to a steam table.

TRAINING THE FACULTIES.

Nikola Tesla was talking about his student days at Prague. "I remember well at Prague," he said, "an old professor of great originality and acumen. This professor insisted on the value of a free use of the perceptive faculties, and he was always pointing out the need for this use in strange ways.

"One day, on arising to lecture, he began: 'Gentlemen, you do not use your faculties of observation as you should.'

"He laid on the table before him a pot, filled with some vile-smelling chemical compound—a thick, brown stuff.

" 'When I was a student,' he went on, 'I did not fear to use my sense of taste.'

"He dipped his finger deep into the pot and then stuck the finger in his mouth.

" 'Taste it, gentlemen. Taste it,' he said, smiling grimly.

"The evil pot passed round the class, and one after another we dipped our fingers in it and then sucked them clean. The taste of the thick brown compound was horrible. We made wry faces and spluttered. The professor watched us with a grim smile.

"When the pot was finally returned to him, his thin lips parted, and he gave a dry chuckle.

" 'I must repeat, gentlemen,'' he said, 'that you do not use your faculties of observation. If you had looked more closely at me you would have observed that the finger I put in my mouth was not the one I dipped into the pot.' "

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

BIG MACHINE TOOLS.

PROBLEMS affecting big machine tools have become more complicated than of old because dimensions have increased so greatly. The points of similarity between the tool of medium size and the mammoth one are dwarfed beside their differences.

Mass requires solutions of a different kind from those which are applicable to the ordinary machines. It affects both main designs and details, methods of operation and questions of manufacture, transit and fixing, so that a big tool is not merely a common article magnified, but is in most respects a new design which has to be treated on independent lines. Another aspect of the big machine tool is the rivalry between it and the portable type. The relations between the two broad systems are being intensified, but never before have so many portable tools been in service. The question of bringing the tools to the work or carrying the work to the tools is one of the interesting problems of the time of which it would be unwise to forecast the issue.

The question involving mass is often one of several tons weight, and then designs must be carefully worked out with judicious regard to economy, obtained by comparatively thin metal, stiffened liberally, and rendered rigid by ample bracketing, and a tapering of metal, in some cases on the cantilever principle towards over-hanging or unsupported parts.

A big wasted casting is a proportionately heavier loss than a sectional one. A fracture, too, either during erection or while in use is of less moment if the frame of the machine is in sections than if the frame were cast entire. So when machines grow to unwieldy dimensions the cast iron girder or beam often gives place to the built-up plated member. The limitations of plated work are that all sliding bearing surfaces must be of cast iron or gun metal, hence if mild steel is used for main framings the sliding portions must be of cast metal attached thereto. Two problems arise in heavy machines that are not considered in lighter ones. They are counterbalancing and power operation. Counterbalancing is very essential to lessen the strain on the gears and screws and to prevent jerky movements as well as to diminish wear and friction between the slides. Separate motors are very largely used in our days on the larger machines overcoming the problem of power.

The tendency of design in the smaller machine tools is to restrict the range of their operations in order to render them suitable for producing specialties. But the tendency in big tools is in the other direction, namely, to increase their range of utility. For example, we have extension boring and turning mills; combined planing, drilling, milling and tapping machines; heavy lathes capable of doing work between centres, turning face work and screw cutting; duplex boring mills with adjustable centres capable of being operated simultaneously or independently.

Another variation in old practice brought about by the increasing size of machines consequent on growing massiveness of work is the travel of tools over the fixed work. The difficulties of belt driving increase with the power absorbed by machines. A short, wide, thick belt is difficult to keep in working order, and the bearings adjacent are greatly stressed. The electric drive has come opportunely here, though the high motor speed involves more reduction gear than it does on the smaller, quick-running machines, but a good worm gear again solves this difficulty. The increase in dimensions of machines has thus been conducive to an extension of electric driving and in a similar way to that of over-head travelers. The question of transport is another that arises in connection with big machine tools.

It is hard to say when the limit of size will be reached. As long as the dimensions of ships are increased and the diameters of electric generators, the size of guns, etc., the growth must go on. Plates, forgings, and castings, and the demand for higher speed, feeds and duties, the growth of the high speed steels, and lastly the need for bigger machine tools to manufacture new machines, are all favoring the growth of more massive structures with the problems to which they give rise.—Cassier's Magazine.

THE DESIGN OF FLY WHEELS.

ONE subject that has received very little attention by those concerned and in most of the books devoted to the design of the steam engine is the design of fly wheels. It is agreed that the fly wheel is a nuisance, but there is no need of having it bigger or heavier or more dangerous than necessity demands.

In any engine, the turning effort on the crank-shaft varies with the angle turned through by the crank, for various reasons—the steam pressure on the piston varies throughout the stroke—the angle between the crank and connecting rod varies, so that the effective arm of the thrust of the connecting rod varies, and the inertia of the moving parts, together with their weight, all tend to cause a variation in the angular velocity of the crank shaft, which variation is cyclic, that is recurring, each stroke.

This fluctuation of velocity we shall call the primary fluctuation.

Then again the pressure of the supply steam may vary; and also the resisting moment of the load, as applied to the crank shaft, will vary from time to time as more load is thrown on or off, and this variation in the case of an engine driving a rolling mill, or driving a tramways load, may be exceedingly rapid, practically the whole load being thrown on or off almost instantaneously. This variation—which is not cyclic—causes a fluctuation in the angular velocity of the crank shaft, which we shall call the secondary fluctuation, and which is much more important than the primary.

In the steam engine we have two pieces of mechanism, each of which in its own way tends to reduce the magnitude of these fluctuations—the governor and the fly wheel. From the nature of the governor, it is obvious that, before any regulating action can be called into play, the speed of the engine must have already increased; and it is also obvious that, since the governor acts by cutting off or throttling the supply or working fluid, it is quite unable to prevent any fluctuation which may take place, due, say to load being thrown off after the point of cut-off in any stroke, until the next stroke. The governor thus takes care within certain limits, of the fluctuation from stroke to stroke, but does not affect the primary fluctuations, which, along with such a fluctuation as

just stated, are left to be regulated by the fly-wheel.

This regulation is accomplished, by the fly-wheel having its angular velocity, and hence its kinetic energy increased, when the power being developed is in excess of that being absorbed by the resisting moment on the crank shaft; and by again giving out this store of kinetic energy, and hence, having its angular velocity diminished, when the demand for work at the crank shaft is greater than the supply at the engine-cylinder.

In this paper the author deals very exhaustively with the design of fly-wheels as figured from a theoretical standpoint—A. H. Gibson, D.Sc., Engineering Review.

POWER GAS.

In the gasification of carbon, under the action of oxygen, carbonic acid, and water vapor, the following reaction occurs:

	Reaction	Heat in furnace. Units.	Calorific value of gas obtained. Units.
1	$C+O_2=CO_2$	97,600	
2	$C+O=CO$	29,400	68,200
3	$C+CO_2={}_2CO$	−38,800	136,400
4	$C+H_2O=CO+H_2$	−28,800	1-6,400
5	$C+{}_2H_2O=CO+{}_2H_2$	−18,800	116,400

Twelve kgs. of carbon, on being burnt to carbonic acid, thus yield 97,600 heat units, while in gasefying 12 kgs. of carbon by 44 kgs. carbonic acid (according to 3) 38,800 heat units have to be supplied in the furnace, the 56 kgs. carbon monoxide obtained, possessing a calorific value of 136,400 heat units. In the gasification of carbon the heat is only evolved by free oxygen, whereas bound oxygen absorbs heat. The heat exchanges in reactions 2 and 4 have been calculated from combustion values of carbon and carbon monoxide.

Deville was the first to show that on carbon monoxide being passed over soot, carbon dioxide was formed at the temperature of softening glass in very small amounts, and at temperatures below the melting point of silver at very high rates, carbon being given off, according to $2CO = C + CO_2$ 38,800 heat units being freed according to equation 3. Mallard and Le Chatelier have shown that carbonic acid is decomposed to an appreciable amount only at a temperature of 2,000 degs. Cent. According to researches by C. Langer and V. Meyer, carbon monoxide is partly decomposed at about 1,700 degs. Cent., while carbon is given off: $2CO_2 = C + CO_2$ Carbonic acid can be heated in platinum vessels up to about 1,700 degs. without decomposition. On leading oxygen slowly above retort coal Mr. Lang obtained exclusively carbonic acid at 500 degs. Cent. According to Naumann and Ernst, increasing amounts of carbon monoxide are formed with increasing temperatures on leading air slowly above coke, while at 1,000 degs. it is formed exclusively.

According to Boudouard a mixture of 27 per cent. carbon monoxide and 73 per cent. nitrogen, on being led above coal at 800 degs., gives 0.6 per cent. carbonic acid. Carbon monoxide, on being heated with charcoal to 550 degs., gave, after 1 hour, 94 per cent. of carbonic acid and 6 per cent. of carbon monoxide. Varying figures were obtained on heating carbonic acid with charcoal according to the temperature, as well as the nature and shape of the fuel, it being shown that the rate of the reversible reaction

$$2\,CO \rightleftarrows C + CO_2$$

is dependent on the above factors. Anyhow a long time is required for the state of equilibrium to be reached.

Hempel tried to utilise air rich in oxygen (50 per cent. oxygen) for generating producer gas, and very large amounts of carbonic acid were obtained in spite of the very high temperatures. Experiments by Wieland showed the ratio of carbon monoxide to the carbonic acid to increase with the temperature and duration of contact.

It has been known for a long time that water vapor, on being led above incandescent coal, forms hydrogen, carbonic acid, and carbon monoxide. The gas thus obtained contains, according to Bunsen, one volume of carbon monoxide for each two volumes of carbonic acid. The action of water vapor on brown coal coke, according to experiments by the author, begins at about 400 degs., and the action on gas coke at about 530 degs., according to Lang's experiments. The gas issuing at 630 degs. in a slow stream has the following composition—Carbonic acid 20.4 per cent., carbon monoxide 0.9 per cent., hydrogen 39.8 per cent., nitrogen 38.9 per cent.—By Ferd. Fischer.

CIRCULATION OF WATER IN STEAM BOILERS.

Efficiencies of a steam boiler depend very greatly upon the activity of circulation of the water within it. All its other qualities, strength, durability, ease of access for repair, are secondary. Combustion may be perfect and the proportions of grade and heating surface correct as far as experience can suggest, but if there be little or no circulation of the water from the hottest to the coldest parts, and the reverse, the boiler will be sluggish, slow to generate, and quick to lose steam whenever a sudden demand is made upon it,—in a word, inert. Defective circulation is very common in many types of boilers and accounts for most of the troubles experienced from lack of steam where there should be plenty. There are three kinds of circulation in steam boilers, natural, artificial and forced. As regards natural circulation, the vertical tubular boiler has none. The experiments to determine the circulating efficiency of an inclined tube showed that the tendency was to drive the water upward, but by this no new practical knowledge was gained. It is inferred that owing to the tubes absorbing a less and less amount of heat as they ascend and as a consequence delivering their heated gases into the chimney at a continuously increasing temperature. Examination of boilers shows that the sediment of scale left by evaporation of the water is by no means evenly deposited all through the boiler, some parts being thickly covered with it while in others there is little or none. Not the least evil which poor circulation of the water in a steam boiler entails is that of uneven expansion. Undoubtedly this is an important factor in shortening a boiler's life; certainly it necessitates frequent repair and renewal. When it is borne in mind that the plates of some boilers are over an inch thick, it can be appreciated that the strain induced by such expansion must be enormous.—Cassier's Magazine.

THE CUTTING ANGLE OF TOOLS.

Dr. C. J. Nicholson, of the Manchester Technical Institute, formerly professor of mechanical engineering in McGill University, has probably made more exhaustive tests on this subject than any other person, both in connection with the proper angle for a cutting tool and the power absorbed under different conditions. The necessary reconsideration of the design of lathes, for the rapid and heavy cutting, rendered possible by the new tool steel, led him to undertake a thorough and systematic investigation of the forces acting upon a cutting tool, during which he made over 300 trials, from which the following resume is made:

The opinion generally held concerning the relation of the cutting force to the depth of cut was that—as first enunciated by Hartig—the former varied in simple proportion to the latter. This law of variation has been the subject of controversy. The results of Dr. Nicholson's research substantiate Hartig's law approximately.

The apparatus used consisted of two specially arranged dynamometers cap-

able of measuring forces up to 15 tons on the tool-point when taking a cut; the force-mearurer itself consisting of a hydraulic support and a Bourdon gauge. The chief conclusions deducted from the experiments are as follows. In the case of medium cast-iron the variation of the cutting-stress with the cutting angle is very marked. It varies by nearly 100 per cent. of its smallest value, which takes place, in every case, for a cutting-angle of about 60 degrees. This angle of minimum cutting-force is by no means that of greatest durability. A cutting-angle of 80 degrees is that indicated as being best for shop use, and the cutting-stress for this angle is about 75 tons per sq. in. In the case of soft steel the variation of the cutting-stress with the traverse in the case of soft steel is somewhat complicated. For keen cutting-angles (below 75 degrees) fine traverses require less cutting-force than wide ones; whilst for blunt-nosed tools (i. e., cutting-angles greater than 75 degrees) the reverse is the case, and the fine traverse cut requires the greater effort to remove. At a cutting-angle of 75 degrees the stress is the same whether the traverse be 1-16 in. or ⅛ in., and has the value of about 100 tons per sq. in. It is curious to remark that this angle of 75 degrees is also about the best angle for shop use. Ordinary shop-tool, when cutting soft steel of this quality, exerts a vertical force of 100 tons per sq. in. of area of cut removed, irrespective of the proportion of width of traverse to depth of cut.

Experiments made for examining the durability of different cutting angles showed that a cutting-angle of from 75 degrees to 80 degrees, with tools of 45 degrees plan-angle, were the most durable for medium cast-iron. As the cut three-sixteenths inch was somewhat shallow, and the tool points had a small radius, about 3-32 inch in plan, the shaving moved off in a direction nearly perpendicular to the axis of the work, instead of at right angles to the cutting-edge of the tool. This means that the actual cutting-angle, measured in the direction of motion of the shaving, was about 81 degrees.

Tools should, therefore, be ground for maximum endurance in the cutting of cast-iron in ordinary shop practice, so that their true cutting-angles are about 81 degrees; or, if they are allowed 6 degrees clearance for working on the level of lathe centres, they should have an included angle of about 75 degrees. In the case of medium fluid-pressed steel the trials seemed to show that a cutting-angle of about 70 degrees (included angle 65 degrees) is that which will last the longest in rapid cutting. The plan-angle of the cutting edge was 45 degrees throughout.

AIR COMPRESSORS AND THEIR VALVE GEAR.

Air compressors from a valve gear standpoint are divided into two classes, those having automatic valves and those in which the valves are positively controlled. Many compressors combine the two classes. In comparing the merits of automatic and positive valve compressors, it is necessary to consider the conditions under which they operate, before a true estimate of their relative advantages can be formed. Dealing first with the suction valves, those of the automatic class have the advantage that no extraneous gear such as eccentric rods and levers are necessary; but on the other hand the fluid resistance of an automatic compressor exceeds that of the positive type.

In compound compressors the low pressure or intake-cylinder may with advantage be fitted with mechanically-moved valves for both suction and dedelivery, because in this cylinder a constant delivery-pressure to the inter-cooler is obtained in spite of fluctuations in pressure in the delivery main; and when the valves have once been set they require no further adjustment in the timing of their functions. It has been previously stated that the fluid resistance on the suction-stroke has a considerable effect in reducing the capacity of a machine, but in the second cylinder it has little or no effect on the output.

If in entering the cylinder the air passes in thin streams through hot passages or ports, or past hot valves or seats, it will become rarefied, and thereby reduce the capacity of the compressor. The valve arrangements should, therefore, be designed to avoid this effect as much as possible. The passages leading to the suction port, should be kept away from the heat of the cylinder, and should be as large and as direct as convenient. Automatic delivery valves of air compressors, are by far the most common type, and when well designed, are quite satisfactory, and it is not uncommon to find machines having positive suction and automatic delivery valves. The great difficulty with delivery valves of the automatic type is to avoid the severe banging or slamming to which they are liable.

Few classes of machinery are subjected to more severe stresses than steam-driven air compressors; and as these may, for the most part, be eliminated by a judicious valve-setting it will be convenient to consider the matter in the present article. The great shock with most compressors occurs on the dead centre when, under ordinary conditions, the load on the piston-line is equal to the sum of the steam and air-piston loads; for when the crank is in this position the full steam pressure is on the steam piston due to lead of the steam valves, and also on the air-piston, and as both these forces are acting in one direction the resultant force is the sum of the two components. To resist this great force, most modern compressors are made extra strong in all parts between the crank shaft and the steam cylinder. The piston-rod is larger in diameter at the crank end of the steam cylinder than between the steam and air cylinders, a state of things which appears to be absurd until the nature of the stresses is thoroughly appreciated. To avoid this shock it is only necessary to dispense with lead and set the steam-valves so that the port is not opened until the crank has passed the dead centre.

Besides the types already mentioned, the hinge valve is sometimes employed. This valve, however, is liable to severe banging unless the lift is small, and there is special gear provided to prevent dancing on the face. For low pressures, slide valves are sometimes used, but it is obvious that this type is not well adapted for giving small clearances. Blowing engines, which are a type of low-pressure air compressors, have sometimes been fitted with rubber valves, and sometimes with valves of leather; but such designs are necessarily limited to low pressures, both on account of their being unable to resist high temperatures as well as high pressures.—Engineering Review.

MOMENT AND THRUST OF TWIST DRILLS.

At the convention of the American Society of Mechanical Engineers, Prof. W. W. Bird and H. P. Fairfield, of the Worcester Polytechnic Institute, describes a twist drill dynamometer, i.e., a machine for testing the moment and thrust of a twist drill. Tests were made, and it was found that with soft gray cast-iron and a Novo steel drill, the power required for a drill varies directly with the number of revolutions, while the thrust does not increase with the speed, but depends on the feed per revolution; and also that less power is required to drill a given hole in a given time by increasing the feed per revolution than by increasing the revolutions.

In other experiments it was found that the thrust would be decreased by having more of a point on the drill; and that a drill ground at an angle of 45 degrees could do the work as well as one ground at 59 degrees and with less thrust. The power required to drive the drill does not vary with the change of angle. The thrust on a ⅝ in. drill was reduced about one-half by previously removing the centre of the hole with a 1-10 in. drill.

Manufacturers in Parliament

AMONG Canadian industrial cities, Brantford occupies a foremost position, and it is seemly that her new member should be one of her commercial leaders. Mr. Cockshutt is the second son of the late Ignatius Cockshutt, and was born in Brantford in 1855. He attended school at Brantford and at Galt, later proceeding to

W. J. Cockshutt, M.P.

England, where he entered the produce firm of Thomas Furness & Co., Hartlepool, Durham. Following this he spent some time in the tea warehouse of Bates, Evans & Co., London, where he completed his business training. On returning to Canada, Mr. Cockshutt managed his father's business, which had been founded by his grandfather in 1829, until March 15, 1882, when he bought out the stock and completely refitted the double store—one devoted to hardware and the other to groceries. The former he recently sold, but the latter he still continues. His largest interests are, however, centred in the Cockshutt Plow Co., a firm engaged in the manufacture of plows and other agricultural implements. Mr. Cockshutt has always been a strong supporter of the Board of Trade, both in Brantford and Toronto. He is an eloquent speaker, and his entry into Parliament adds one more to the ranks of the orators

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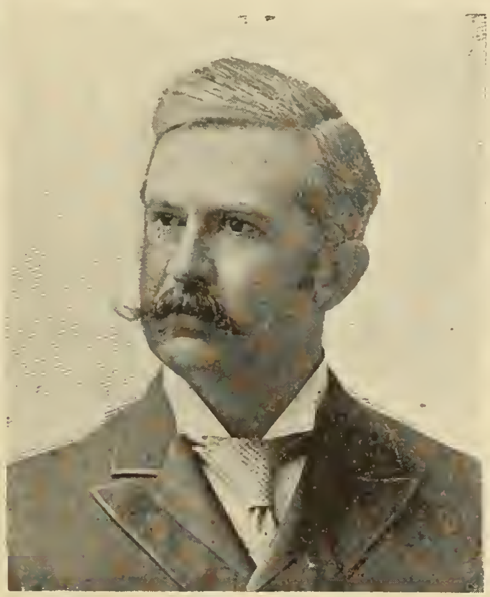
Mr. A. E. Kemp, who carried East Toronto by an overwhelming majority on November 3, is of English descent, though born at Clarenceville, Quebec, on August 11, 1858. His grandfather came from Hull, England, settling first in Montreal and then in Toronto. The member's business career opened in Montreal, when as a boy he entered the firm of Prouse Bros., rising to be cashier. After five years' service, he started into business for himself in the wholesale furnishing line. In 1885 he moved to Toronto, and two years later he succeeded to the business of the Dominion Tin and Stamping Works, a manufacturing concern which had started operations in 1866. Mr. Kemp has had remarkable success in the industrial world, and today the firm of A. E. Kemp & Co. is known far and wide, as one of the premier institutions of Canada. Over 300 hands are employed, and over 2,000 different articles of metal are manufactured.

Mr. Kemp has always taken a promin-



A. E. Kemp, M.P.

ent position in the business life of his home city. He became a member of the Board of Trade in 1891, and passing through the various stages of office, ultimately became president in 1899, holding that important position for two years.

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Mr. Herbert B. Ames, who successfully contested the St. Antoine Division of Montreal, is best known as a champion of municipal reform, having been identified with the reform movement in municipal politics in Montreal for several years. He was born in Montreal in June, 1863, the son of the late E. F. Ames, who came to Montreal half a century ago and established what is now the important boot and shoe business of the Ames-Holden Co., employing 325 hands. Mr. Ames graduated from Amherst College in 1885, entering the employ of his father's firm in August of that year, where he rapidly gained a complete insight into the business. Though still a director of the company and largely interested in its welfare, Mr. Ames has, since 1893, devoted himself more particularly to politics. In January, 1903, Mr. Ames was elected to the Council of the Board of Trade, a proof of the confidence the business men of Montreal place in his ability. As a member of the board he had much to do with making the Chambers of Commerce Congress last summer a success. Later on he was enthusiastically received in Britain, when, in company with other Canadians, he returned the visit of the British delegates. His interests extend in many directions. He is a director of the Great Western Life Insurance Co., and of the Dominion Guarantee Co. He is also a member of the Protestant section of the Quebec Council of Public Instruction, and a governor of the Montreal Dispensary.

H. B. Ames, M.P.

Baines & Peekover, of 124 to 126 Bay street, Toronto, have decided to issue a monthly steel stock list of various kinds of steel manufactured by B. K. Morton & Co., of Sheffield, Eng. The list will appear the first of each month

Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

ELECTRICAL PROGRESS IN CANADA.

NOW there are throughout the world over one million miles of telegraph line and over four million miles of wire. These represent an outlay of capital equal to $500,000,000. The outlay for cables will increase the total capital invested to $850,000,000. Over head and under seas there is a daily transmission of 1,500,000 telegrams and 36,000 cable messages, the yearly totals being 557,000,000 land messages and 13,100,000 cables in 1903. Everyone knows the important part the newspaper telegraph service plays in a country of magnificent distances such as Canada, where for months, during which the Federal Parliament sits, the whole country is absolutely dependent upon the daily telegraphed report for a knowledge of the proceedings. Divided by ten to represent an ordinary message, the millions of words of press 'flimsy'' would far exceed the other messages sent and delivered in the course of the year, and representing the business, the social and other activities of the country employing the telegram as a medium of communication.

Canada in 1903 had 36,780 miles of line and 96,728 miles of wire, and her record is 5,313,800 messages, or just about one message for every man, woman and child on her broad acreage. In the matter of miles of wire Canada somewhat exceeds the United States, having 18,250 miles per million inhabitants against the United States equipment of about 13,000 miles per million.

Electric Propulsion.

It is about sixteen years since the scientific practicability of propulsion by means of electricity was demonstrated.

In the United States there are about eleven hundred street railway systems (The United States census returns give 871 street railways, chiefly electric, for 1900.) There are 25,800 miles of track: the capitalization is $1,630,000,000 and the funded debt $1,275,000,000. The earnings were over $240,000,000 last year, between $600,000 and $700,000 a day.

The United States have made great progress. They have 322 miles of electric railways caried last year 167,704,-lation of Continental United States. These carried between 5,000,000,000 and 6,000,000,000 persons, or about sixty-five times the population, and about eight times as many as the steam-driven railways carried. Canada's electric railways carried last year 167,704,-000 passengers, or about thirty-one times the population of the Dominion.

When it is recalled that the urban population of the United States forms over 37 per cent. of the whole, while Canada's urban population is only 26 per cent., it is evident that the electric railways of the Dominion are doing well and give promise of doing better; as Canada's urban population, following the continent's trend, increases its proportion, Canada's electric railways carried like those of the United States, about eight times as many passengers as her steam-driven railways.

Ottawa claims to be the first city in Canada to adopt electricity as the motive power of street railways the Ottawa Electric Railway Company beginning its career in July, 1891. The development in Canada is, therefore, all within twelve years. That of the United States began in 1888, when there were under 100 miles of electric railway in the country.

Telephones.

The Summer of 1904 was the thirtieth anniversary of the invention of the telephone. In 1874 Mr. Graham Bell, then on a visit to his parents, who lived in Brantford, made some laboratory experiments which proved that speech could be transmitted by wire. Two years later, August, 1876, the first transmission of speech over a telegraph wire took place in Brantford. In 1877 the telephone went into commercial use, the city of Hamilton being the first to establish it.

From that beginning the use of the telephone has been constantly on the increase. The first returns the Statistical Office secured showed that in 1883 Canada's equipment was 44,000 miles of wire; 35,500 instruments.

Taking the population of the last census, there is in Canada one telephone instrument to every 65 persons.

Provinces.	Number persons to one telephone.
Ontario	57.9
Quebec	63.8
Nova Scotia	99.4
New Brunswick	85.3
P. E. Island	215.0
Manitoba	51.5
N. W. Territories	251.3
British Columbia	33.4

Electric Light, Heat and Power Companies in Canada.

The equipment of electric light, heat and power companies with which Canada has provided herself is of comparatively recent date. No mention is made in the census of 1881 of the industrial employment of electricity.

Figures show a large increase in twelve years: Of establishments, 236; of employes, 1,023; of capital, $15,886,229; of wages paid, $598,531; and of output, $3,655,078.

The following are the returns of 1891 and 1901 for establishments employing five hands and over:

	1891.	1901
Establishments	23	58
Employes	630	899
Capital	$3,185,257	$11,891,025
Wages	237,348	451 047
Output	845,134	2,008,017

Expressed in percentages, the increases are: Establishments, 121 per cent.; employes, 43 per cent.; capital 273 per cent.; wages, 90 per cent., and output, 137 per cent. In 1891 the yearly wages of the employes averaged $376.75; in 1901, $501. The annual output per employe in 1891 was $1,342, and in 1901, $2,234.

Of the provinces, Ontario is far away the chief employer of the electric light. This province had 203 of the 324 plants in use in the Dominion. It has considerably more than one-half the total number of arc lights, and 47 in each 100 of the incandescents. Thirty-four municipalities in the province supply themselves with electric lighting.

The largest single plant in the Dominion is that of Toronto, with its 170,000

lamps, arcs being taken as each equal to 10 incandescents. The next largest is that of the Lachine Rapids Hydraulic and Land Co., Montreal, 158,503. The third in size is the Ottawa Electric Co., with 111,927 lights.

Of electric arc lights and carbons and carbon points, Canada imported during the past fourteen years an average of $35,000 worth a year. The imports for 1902 and 1903 averaged $1,090,050 a year, and the imports for the year ended June 30, 1904, were $2,406,912.

In detail the imports of Canada for the last fiscal year were: Electric light carbons over 6 inches in circumference, $62,794, all other electric light carbons, $25,985; electric motors, generators, dynamos and sockets, $488,944; electrical apparatus, insulators, electric and galvanic batteries, telegraph and telephone instruments, $1,829,189; a total of $2,406,912.

It may also be mentioned incidentally that of this total $2,332,899 were imported from the United States of America.

It appears that the outlook for Canada is one that shows the country going forward by leaps and bounds in its application of electricity. Electricity will drive the carriages on the King's highway as well as those on the iron way. It will do her plowing, sowing and reaping. It will make trolley parks an important part of the national equipment for recreation. If it does not help into this life it will help some one out of it, by order of justice.—George Johnsen, Statistician of the Dominion of Canada.

DISTRIBUTION OF ELECTRICAL ENERGY.

IN this article, the author takes up the question of the distribution of electrical energy, criticizing the systems of supply and discussing the results of the work of the Engineering Standards Committee. The distributing systems likely to be adopted are: (1) Direct-current, two, or three-wire, for small districts. (2) Single-phase high-tension for railways. (3) Two-phase high-tension sub-station method, the redistribution (for existing single-phase systems of general supply. (4) Three-phase high-tension generation and direct-current low-tension distribution (for existing direct-current systems in large districts, and for railways of short length). (5) Three-phase high-tension generation and low-tension three-phase or six-phase distribution (for entirely new and large districts).

Diagrams accompanying the paper demonstrated the economical radii of supply by direct current at 500 volts for different loads transmitted and by the high-tension sub-station method, the results being that above the undermentioned distances the high-tension method is more economical, viz.: 250 k.w., economical radius, 1.6 mile; 500 k.w., economical radius, 1.25 mile; 1,000 k.w., economical radius, 1.06 mile.

He shows that for general purposes in Great Britain, 6,000 volts for underground work is approximately the economical pressure. He deals with the question of cost of over-head transmission of high-tension currents and fixes upon a pressure of 20,000 volts as a standard. The methods of distributing energy at low pressure are classed as follows:

Conduct of Drawn-in System.

(1) Bare-copper-strip systems, strained and unstrained. (2) Cables insulated by India-rubber, vulcanized bitumen, or other dieletrics drawn into stoneware casings, Callender-Webber bitumen casings, fibrous conduits, cement casings, and cast-iron or wrought-iron pipes.

Buried or Solid System.

(1) Vulcanized bitumen, dialite or other insulated single cables, laid in iron, stoneware, or wooden troughing, and surrounded by molten bitumen or pitch. (2) Concentric cables, paper insulated, and lead covered, laid in the same manner. (3) Single-phase or concentric cables, each protected by its own sheathing of steel tapes or wires, laid direct in the ground.—J. F. C. Snell, Pr. Inst. C.E.

PIONEER WORK IN POWER TRANSMISSION.

THE development of the Telluride Power Transmission Co., in Colorado, marks the pioneer work in high tension electric power transmission. At this place during the winter of 1890 was installed the first commercial high pressure alternating current power transmission of the world. The cost of power by steam had been prohibitive and steps were taken to utilize the abundant water power in the district.

During the investigation which followed while selecting apparatus, little but incredulity or ridicule was encountered. Eastern investors in the enterprise were annoyed by predictions of prominent engineers, and discouraged by their insistence, that the experiment would prove a miserable failure and the expenditure go for naught. It was said that there was no alternating-current motor; that oil insulators must be used, and that the line must be fenced in. However, a generator and a motor for 3,000 volts and of 100 horse each were ready for trial in the fall of 1890.

Difficulties caused by ice at 40 degrees below zero, by speed control over unusually high water pressure, by avalanche, by blizzard, by electric storms unknown in low altitudes, and scores of others, now generally forgotten, but then most serious, marked every step of progress. Notwithstanding all of these, unqualified success from the beginning caused gradual and constant growth, until at the present time the Telluride Company and its allied industries have six power stations and nearly a thousand miles of line in Colorado, Utah, and Montana.

The initial insulation comprised a generator which was belted to a six foot Pelton wheel. Switch boards consisted of matched and shellacked pine sheathing, and the bases of instruments were dry hardwood. Only voltmeters and armetres were used, both of the solenoid and gravity balance type in black walnut cases with window glass fronts. Circuits were closed with jaw switches and opened by arc-light plugs. The line carried two No. 3 bare copper wires mounted upon short cross arms and insulaters. The copper cost about $700 or about 1 per cent. of the estimated cost for continuous current.

When it was reported in the East that a hundred horse power was being successfully transmitted nearly three miles over No. 3 copper with less than 5 per cent. loss, it was received with the utmost incredulity.

At first no transformers were used between the machines and lines, the largest transformer adopted later being 2 k. w., or 40 light. Another transformer was received later of larger capacity, and all suffered from lightning punctures. In 1893 the alternators were parallel and were so operated thereafter, with full load upon the smaller and regulation upon the larger machine. There were no circuit breakers on the system.

The commercial feasability of high pressures was demonstrated by the successful operation of one mill during a great part of the year 1895 at pressures from 30,000 to 60,000 volts. Improvements were adopted and apparatus added with the development of electrical engineering. Their experience with oil transformers for 10 000 volts and the refusal of manufacturers to give any guarantees whatever for any transformers for higher pressures led the Telluride Company when undertaking this 10,000 volt transmission to manufacture its own.

The Provo Plant, in first transmission of more than 16,000 volts, while undertaken in advance of the art and not exempt from its share of troubles, has, nevertheless, been fully successful as a financial venture, and not without value in the progress of science.—P N Nunn, in Cassier's Magazine.

PRECAUTIONS IN THE USE OF ELECTRICITY.

A CIRCULAR letter was issued by the Home Office of Great Britain enclosing proposed regulations as to the use of electricity in factories. It is indicated that a Committee of Inquiry will be appointed if it is considered advisable before such regulations become law. In this connection the following amendments to the draft regulations are suggested for consideration at any inquiry which may be instituted.

The total enclosing of wires in strong metal casings is objected to on the grounds of (a) Inaccessibility of conductors; (b) Difficulty in maintaining satisfactory insulation resistance between conductors and earth, owing to the condensation of moisture in such tubing; (c) Difficulty of inspecting the condition of conductors when in service; (d) Difficulty of localization of faults and the remedying of same due to the inaccessibility of conductors; (e) Increased first cost. Cables supported on insulators spaced a suitable distance apart are readily accessible and enable the insulation resistance to be maintained at its maximum value. It is suggested that the Clause referred to be amended as follows:— "All wires in connection with the supply shall be so arranged that there shall be a minimum danger from shock or fire. Where readily accessible the wires shall be completely enclosed in strong metal or other approved casing."

It is suggested that where suitably designed automatic circuit-breakers are used, it is unnecessary to use switches in series with them, as an automatic circuit-breaker is an equally reliable device to a switch, and, in general, is better adapted to open a circuit under emergency conditions. The addition of a switch under the circumstances, increases the first cost of the installation without increasing the safety of the arrangement. It is therefore suggested that the Clause dealing with this be amended as follows:—"All mains and branch circuits should be protected by switches and fuses, or by automatic circuit-breakers. Where circuit-breakers are used on one pole only they shall be fitted either with a free handle device, or equivalent, to prevent the possibility of a circuit-breaker being held in on a short circuit."

As regards the switching arrangement for arc lamps, it is suggested that the extra cost and complication of a separate switch to each lamp, owing to the grouping of lamps connected across a 500-volt circuit, besides the extra cost involved in the wiring, is unnecessary. It is, therefore, recommended that the latter part of this Clause be amended as follows:—"That where arc lamps are connected in series across conductors on a circuit, the pressure of which cannot exceed 650 volts from earth, it shall be sufficient if one double-pole switch, conveniently placed, be provided for each such series of arc lamps."

As regards the words "All metal holders for incandescent lamps" in Clause 5, it is suggested that this would increase the cost of the installation of electric lighting in factories in many cases to a prohibitive extent, and would entirely prohibit the use of plain pendant fittings—in positions for which they are eminently suited. The provision of earth wires for the metal parts of all such fittings, even if practicable, would be a serious item. Further, in the event of the lighting being connected to a 3-wire system with a grounded neutral and an earth occurring on to the metal work of the fitting, the full potential between the outers of the 3-wire system would exist between the fitting and earth. The omission of the words "All metal holders for incandescent lamps" is, therefore, suggested, so that the amended clause will read:—"The frames of all motors and metal casings of all wires, switches, fuses, and cut-outs shall be efficiently connected to earth."

THE TELEPHONE IN THE UNITED STATES.

THE telephone is one of the things that characterizes American cities and distinguishes them from those in England. They are to be found literally everywhere. On the office desk the telephone instrument is as regular a part of the equipment as the inkstand. In your hotel you find a telephone in your room, from which you can talk not all over the city, but all over the country. In the street you are never out of sight of a sign informing you that there is a public telephone within. In your friends' houses the telephone is available upstairs and downstairs, it finds a place in my lady's boudoir as well as in the hall or library.

Every good-class shop has the telephone service, and most of the larger establishments have elaborate exchange installations with a telephone in every department, so that customers can talk directly to the particular branch with which they have business. The convenient public telephone station is to be found wherever a public telephone is likely to be wanted,—in the principal railway stations, in hotels, restaurants and theatre lobbies, in all the large shops,—or "department stores," as they are called,—and in very many small ones much used by the general public, such as tobacconists and chemists; in fact, except in a church, one is never out of sight of the ubiquitous telephone in an American city. The casual or general public use of the telephone is catered to so completely that in many restaurants connecting points are provided at different parts of the room to which a portable telephone set may be joined in a moment, enabling customers to telephoane messages between courses.

The rapid march of invention in telephonic working is well illustrated by the history of the New York system. Up to 1888 the New York exchange was operated by means of overhead wires, and single, or earthed, circuits. A law was passed about that time forbidding the use of overhead wires, and underground conduits had to be built and metallic circuits adopted, as single-wire circuits will not work in underground cables. This involved the reconstruction of all the exchange switchboards. The work of replacing the condemned pole lines by underground cables and of bringing the new exchanges into use occupied two or three years.

Similar changes in the mechanical and electrical constitution of the telephone service have taken place in most of the other cities in the United States during the past few years. In some, for special local reasons, the work of reconstruction has been delayed and is still in progress; but in most places the whole system is converted, and the latest method of working is in general and uniform use almost all over the country. The American, wherever he goes, finds a uniform style of telephone and a uniform method of operating the service. The precise degree of efficiency of the service in point of speed may vary in different places, as this is to some extent dependent on the personal equation both of the management and of the subscribers, but everywhere it is high.

One of the very interesting features of the telephone industry in America is the systematic education of the public in the peculiarities of the telephone service which has been undertaken by the American telephone companies. Newspaper advertising is supplemented by attractively-printed and illustrated circulars and booklets, which are issued at frequent intervals and distributed wherever it is thought interest in the telephone service can be aroused. In these publications not only are the advantages of the service and its application to all kinds of business and social requirements expounded, but pointed information is given as to the proper use of the service, the effect that one subscriber's use of it has on that of another, the suitability of certain classes of service to certain situations, and so forth.—Cassier's Magazine.

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MACHINERY AND POWER.

FOR several years there has been a widespread recognition of the need of a distinctly machinery paper in Canada—a paper that should be devoted exclusively to machinery, power, and allied interests.

Canada has reached the point where industrial expansion is just as vital to her progress as agricultural or commercial development. For nearly a decade manufacturing has been given a great impetus by the happy combination of good crops, rapidly-increasing population and growth of national sentiment finding expression in wise legislation.

To-day the Dominion is recognized as one of the most prosperous countries in the world; her industrial interests are wide and diversified; her manufacturers are enterprising and far-seeing, ever alert for any improvement in machinery processes or for new developments in factory equipment.

Yet, heretofore, there has been no paper in Canada devoted to that most essential factor in manufacturing, machinery and equipment.

The starting of a machinery paper of pretensions worthy of the field it would be designed to cover has been recognized as not only difficult but financially hazardous. We have fully appreciated these conditions; we have realized the extent of the difficulties in the way. Probably no other class of paper demands an equal expenditure of time, thought and money as does a general machinery paper, covering the field from both the technical and practical viewpoints. So fully have we appreciated these difficulties that we would not have attempted to start such a paper if our faith in the future of Canada had been less buoyant or if our confidence in the enterprise of Canadian machinery buyers had been less strong, or if we had not been able to place behind the new paper a thorough organization and large editorial and business staffs* capable of dealing with the various needs of such a paper, or if we had not developed a wide connection in the machinery trade through Hardware and Metal and Canadian Machinist. In fact this paper is an extension of the department devoted to machinery and power begun in Hardware and Metal several years ago.

Since the definite announcement of our intention to publish Canadian Machinery and Manufacturing News, we have received most satisfactory encouragement from every part of Canada, and definite support, as will be seen from our advertising columns, by a large proportion of the leading manufacturers of the country. In fact, so kindly has been the reception of the paper that its success is practically assured from the start.

In bringing out this, the first issue of the paper, we fully recognize how far short the issue comes from the ideal to which its publishers aspire. We have no desire to apologize for this number; we are willing to allow our readers to judge it for themselves. We are, however, in a position to promise material improvement in the succeeding issues. Already we have the assurance of contributions from men who will be at once recognized as authorities on the subjects to be discussed. Our editorial staff is, we believe, fully competent to make Canadian Machinery and Manufacturing News a credit to the Canadian machinery trade and a paper of practical benefit to all its readers. We are willing to adopt any suggestion or carry out any enterprise calculated to improve the paper in any way. We would appreciate any suggestions or advice, and assure full consideration of same, from any source. Such as commend themselves as practical and advantageous will be carried out in the first issue possible.

* See page 34.

A MANUFACTURING COUNTRY.

CANADA is now beyond the swaddling clothes which stamped her an agricultural or lumbering country, and has reached the point of development which makes feasible the claim that this country is now a manufacturing country.

In twenty-two years the amount of capital invested in manufacturing in Canada has increased from $159,000,000 to $520,000,000, a quite respectable figure. In the two decades we have built up an iron and steel industry, a Portland cement industry, an electrical goods industry, a pulp wood industry, a beet sugar industry, a pork packing industry, garment manufacture—to attempt to enumerate the phases of development would be futile. Whereas twenty-five years ago manufacturing was an altogether secondary phase of our national life, to-day the prosperity and progress of the country depends in large measure upon the welfare of our manufacturing classes. There is laid in Canada to-day the foundation for almost every class of manufacturing, and we are reaching, pushing forward towards the point wherein our industrial concerns will not have to look to foreign countries for equipment and materials, as is now the case.

It is true that our imports of manufactured goods are greater than ever before. Superficial reasoning might ascribe this to reduced domestic production. It is, however, due rather to an expanding demand. Each new industry has created new demands, which are frequently supplied by foreign manufacturers until the industry is so well established that

supplies can be produced to advantage at home.

For instance, practically all the machinery for cement mills, blast furnaces, beet sugar factories, etc., had to be imported. Repairs for some of these can already be secured in the country, and ultimately Canadian makers will be able to fit out any such plant.

Again the expansion and foundation of our machine shops opened up a demand for pig iron. This was imported for many years but is now almost altogether supplied by Canadian furnaces.

So it has been and will be. Canada is to-day a larger buyer of machinery from the United States than any other country in the world. Practically all this machinery is destined to add to our manufacturing equipment and to hasten the time when Canada will be able to compete with the most aggressive nations in the world for the business of the world.

STEAM ENGINE DESIGN.

PREDICTIONS made regarding the relegation of the steam engine to the scrap heap are likely to require some time for their fulfilment. When the steam turbine entered the field, the steam engine received a rude jolt from which it will never recover, but which, however, will not prevent its continuity of service.

Developments are now taking place that will increase its efficiency a good many per cent. These are along the line of high superheat, increased pressure and reduction of clearance spaces in reciprocating engines. The adoption of a high degree of superheat will not only increase its efficiency from a thermo-dynamic standpoint but will lead to the abolition of irregular shaped valves and flanges. Another feature in connection with superheated steam is that cutting, which is a feature with saturated steam just at the point of cut-off or release, no longer takes place. The result of the experiments using a high degree of superheat have been so satisfactory that its general application is assured.

FUTURE ILLUMINATION.

SUPERINTENDENTS and foremen are confronted from time to time with the problem of illuminating their shops to the best advantage and it is one that is not easily solved. There are several considerations such as relative cost, location of plant and suitability of light to be decided before the question is answered. In Canada artificial light is a paramount necessity during working hours, on account of the short day for several months in the year. The best work can only be done under the very best conditions of lighting and with fine machine work it is imperative. The incandescent lamp, on account of its portability and ease of adjustment on machines, receives a good deal of consideration. Gas is used in some factories with incandescent mantles and with good effect. Enclosed arc lamps also play an important part in manufacturing establishments.

As far as economy goes, the electric light, which marks the farthest approach in that direction, is still extremely wasteful, over 95 per cent. of the energy consumed going out as heat. The question of economy, however, is not the only one to be considered, for the light of the future must imitate daylight much more closely than those now universally used.

The more diffused the light given out, the more nearly does it approach the ideal condition. An incandescent gas or electric light placed here and there lights the store and shows where things are, yet what the pine torch is to the incandescent lamp, so also is the latter to the light that we are bound to have in the very near future, which is now being perfected in the vacuum tube and at present exemplified in the mercury vapor arc.

Experiments have been made with vacuum tubes, lighted by electric excitation, that give every promise of a revolution in this direction in the near future. Tubes have been made and used that are over 150 feet long, giving out a soft white light throughout their entire length. One of these placed around the walls at the ceiling or overhead in long shops would give a light more nearly approximating to nature than anything heretofore used, while the efficiency is also many times that of the ordinary electric lamp. It is to be hoped that the full perfection of these tubes will not be long delayed, and when they are placed on the market, as they are bound to, at no distant date, they will no doubt meet with the same hearty reception accorded the incandescent lamp a quarter of a century ago.

ENGINE AND BOILER SPECIFICATIONS.

MANUFACTURERS of engines and boilers throughout the Dominion are annoyed from time to time at the manner in which specifications are sent in, upon which they are called to tender. Invariably changes from standard makes and sizes are stipulated, which are of no apparent value, and for no valid reason other than to satisfy the fancy of the consulting engineer in charge of the installation at hand. In many cases, while the changes may be slight, the expense necessary to make such a change is out of all proportion to any real or fancied benefit derived by the alteration. The result is that the manufacturer is placed in a different position altogether in regard to bidding on the contract. If he bids on the specification as detailed he must exceed the regular price for such size or capacity of engine or boiler; and if he quotes regular stock price he is taking a chance of losing a large part of his profit in the expense necessary for making such a change.

Now that the different manufacturers are united and working together on a solid basis, the trouble might be eliminated without any great difficulty. Let the manufacturers and consulting engineers get in closer touch with each other, get better acquainted and discuss matters in common, and let them have a better understanding. When these are effected and they feel to a fuller extent that their interests are in common there will no doubt be less to complain of in future specifications.

INVENTORS AND PATENTS.

SINCE patent laws were first introduced there has been strife and dissatisfaction followed by law suits innumerable regarding the rights and claims of different inventors. The inventor, speaking in a general sense, is a public benefactor, and as such he should receive every encouragement possible by legislation. It is to him we owe our present modern civilization more than to any other. The man who is not satisfied with present conditions, but uses his energy and his genius toward improvement, should have every recognition.

In Canada, United States and England patent laws are different, are subject to different conditions and give vested rights protected for different periods of time. In none of these countries is there any degree of satisfaction existing regarding the law granting letters patent to an inventor.

A universal patent law would do much to overcome the difficulty and there seems no reason why such should not exist, in the English-speaking world at least. These are days of broad views, both in social, political and national life, and this subject is one that affords treatment in an international manner. If Great Britain, the United States and Canada were to appoint a commission of experts to discuss the subject and draught an international patent law, the trouble that obtains at present could be done away with, and another link would be added to the chain of sentiment that is fast binding the English-speaking world in one harmonious whole.

ARE OUR MANUFACTURERS AGGRESSIVE?

THE commercial agent of Australasia draws attention to the fact of the possibilities for Canadian manufacturers in building up a much larger trade with them than has yet been attempted. He makes definite mention of two lines made extensively in this country. One of these is bicycles, in which some trade has been done, but on a small scale. This is one of the items affected by the preferential tariff, and as such should see a big increase. Regarding electrical machinery, nothing at all has been done. Out of an importation of nearly four hundred thousand dollars of electrical machinery and apparatus, we contributed nothing. As conditions are at present this country is absorbing all that is manufactured here of these goods, but even so, our manufacturers should be alive to the fact that there is an immense field within the empire, in countries less developed than our own.

TECHNICAL EDUCATION.

THE ramifications of business and the spread of knowledge are so extensive that to-day competition in manufacturing does not merely consist in meeting the price and equalling the quality of a rival in one's own or a neighboring town.

A manufacturer who is worthy of the name, who endeavors to market his product over any large area, soon learns that competition is universal—he has often to withstand the rivalry of German and Swiss as well as English and United States manufacturers.

In like degree must knowledge increase as competition develops keenness and civilization extends. The fact has long been recognized that the supremacy of British manufacturers is threatened by her industrial rivals, Germany and the United States.

The enterprise of the American is credited as the cause of the encroachments of that country in the world market. With Germany, however, the cause has not been enterprise so much as education, with cheap labor as an additional advantage.

In Germany technical education is the foundation upon which the wonderful industrial structures of that land has been erected. Not only do the leaders, the 'captains of industry,'' equip themselves with a broad technical training in the great universities of Germany, but by means of the wide-reaching technical schools of the land, the artizans and workman of all classes have fitted themselves for more capable, more effective service.

And the German does not content himself with a technical training for a foundation but he continues through life to be most painstaking in his study of the technical papers and text-books provided for him in such generous quantity.

Fast as has been the improvement of United States technical papers competent Canadian engineers do not hesitate to express the opinion that the German papers are decidedly superior to these in breadth and detail.

Canada is destined to be a factor in the industrial world. Canadians must not be content with a second-class equipment for their work. So every means to extend technical knowledge should be encouraged by all and taken adavantage of by those interested.

The Canadian universities are devoting a steadily increasing attention to practical science and it is an encouraging sign that these departments are at once popular and effective.

The technical school system of the country is, however, utterly inadequate to the needs of the hour. In view of this condition every encouragement should be given to well-managed correspondence schools, from one of which we understand over 50,000 students are extending their knowledge and usefulness to the community.

WATER POWER POSSIBILITIES.

AS far as developed water power is concerned Canada ranks second among the nations, but in considering the available supply she is easily first. Of one and a half million horse-power in use we have about a quarter of a million and the United States one half million. Next to Canada comes Italy with over two hundred thousand, followed by France and Switzerland. In all Great Britain there is only about twelve thousand horse-power. Scientists and other authorities tell us that the coming century is to see the countries of large water power resources the manufacturing centres of the world. We have millions of horse-power yet untouched and what that will mean in the development of the country is inconceivable. In the Maritime Provinces, Quebec, Ontario and British Columbia some of the supply has been harnessed, but this is a very small fraction of the total. It was only yesterday that some of our legislators

insisted that this was to be solely an agricultural country, but, as well try to stay the ocean tide, as to keep back the flood of manufacturing industry that is rapidly becoming a dominant factor in the country.

MACHINE TOOL DRIVE.

MACHINE tools have undergone a radical change within a short space of time both in their design and their method of operation. Present practice is in the direction of heavier machines and ones capable of performing more operations than formerly, while the individual motor drive or group driving will entirely replace long overhead shafting where electric power is available. The advantages of the electric drive might be summed up as follows: Safety of operation; economy in space occupied, in transmission and in application; reduction of waste load, skilled attendance unnecessary, flexibility as regards location of tool; heavy foundations unnecessary; no vibration; absence of strain on roof and walls of building hence a reduction in the cost of construction, and lessened risk of breakdowns.

THE MITE - E - MOTOR

SUCH is the name of a machine advertised as "the most marvelous invention that the world has ever known."—A broad statement surely and one worthy of explanation on the part of its promotors. A company was recently organized in Montreal under the name of the Canadian Turbine Propulsion Power and Light Co., which immediately afterwards opened a market to the public for five dollar shares in the company. The Mite-e-Motor, whose marvelous possibilities the world had not as yet known, was the attraction to subscribe. Knowing that our readers would naturally be interested in such a machine, and having several inquiries regarding it, we endeavored to find some particulars thereof, but with rather disappointing results.

It might be mentioned in passing that when a person devises anything new in the mechanical or engineering line, or applies an old principle to a new use, the custom is to have it patented if he wishes to have it put to commercial application. If the invention be a machine, or connected therewith, working models are built and tests made to show the practicability of the device. The result being satisfactory, the same is not long in appearing in the technical press, and if it has any direct bearing on industrial progress, all available data is published and discussed at length. Contrary to all custom, however, and overruling all precedent, the announcement regarding the Mite-e-Motor came to the Canadian public in the form of a page advertisement in a Montreal daily paper.

A representative of this paper called at the street and number mentioned on their circular to get some information about the machine from a technical as well as industrial standpoint. It was found to be the office of the company's broker, who took payment for shares, but knew nothing whatever about the physical properties of the motor. He directed the inquirier to another office on a different street where a model could be seen, adding that if it was with a view to investment they would be glad to show the machine, otherwise they would probably not have time to bother. On arriving at the second office, which was the head office, he was interrogated as to whether he was a probable investor, and assurance being given, was ushered into the sanctum. He was informed that the model had just been taken back to England but that they had a drawing and the machine would be explained from that. An undimensioned tracing was produced and the principle explained.

On different questions being asked, the gentleman representing the company confessed that he was not a technical man, and that their engineer was at present traveling for his health. The detailed drawings of the machine were locked up in the safe, not to be gazed upon by the vulgar eye. He said he had issued a challenge to certain engineers in high authority, but that it had not been accepted. He intimated that one of them had come to see it and had found it all right. On being questioned, he confessed that the latter had taken no stock in the company, mentioning confidentially: "The fact of the matter is, those fellows are sore on us because we would not let them into the company." This statement was denied in toto by the gentlemen referred to, and about the challenge, they had never heard it.

From a purely business standpoint the public should know more about this machine, the possibilities of which are being grossly misrepresented. The investor has a right to demand a more complete knowledge of the machine than is given, but instead of that he accepts with blind credulity what is stated, and says nothing but dreams that he will some day wake up rich.

Looking at the matter from a technical and theoretical standpoint, it is even less plausible. In this issue on another page will be found "Notes on the Efficiency of Gas Turbines," and the machine described there approximates to what is evidently the mechanism intended in the Mite-e-Motor. It may be noticed that the efficiency is 18 per cent., little more than can be obtained from the best cross-compound steam engine, and no wonderful revolution of power is claimed. Where the revolution in power development comes in is beyond conjecture.

With the efficiency to which the machine advertised, were one built, is limited, it is impossible to build a motor weighing but sixty-two pounds to give twenty horse power on a brake test, and we challenge the company to produce such a machine. In describing the machine their technical advisor evidently forgot himself as in describing the turbine he talks about piston velocity, which is absurd. Again, it is mentioned that the compression pressure is practically unlimited. This, too, is outlandish, as there would be a very definite limit to the pressure on account of the temperature. Other points might be mentioned, but enough has already been said.

As the representative machinery paper of Canada, we take the stand that we should protect the public against misrepresentation in the machinery line, and in closing, again challenge the Canadian Turbine Propulsion Power & Light Co. to produce a machine that will fulfill anything approximating the claim advertised for the Mite-e-Motor.

Machinery Development

Metal Working — *Wood Working*

THE CUT-METER.

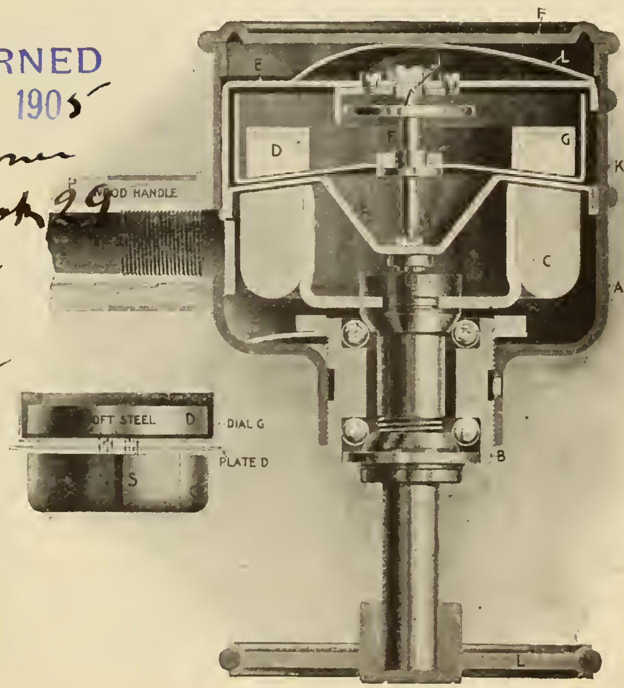
THE Cut-Meter is a combination of the tachometer and a wheel with a certain outside circumference, the tachometer being calibrated so that every foot traveled by the circumference of the wheel registers one foot upon the dial. For instance, if the circumference of the wheel is exactly one foot, it requires only one revolution of the tachometer shaft to register one foot. If the wheel is six inches in circumference, it can readily be seen that it will require two revolutions of the tachometer shaft to indicate one foot on the dial, so that it only remains to properly calibrate a tachometer in order to get the direct reading in feet per minute.

Having these two facts as a basis, it appeared a simple problem to produce the Cut-Meter. But it was absolutely necessary to have a portable tachometer possessing the prime essentials of accuracy in any and all positions; the construction being such as would stand the necessary wear and tear without changing or affecting its calibration. Here the difficulty began, because previous to the invention of the Warner Magnetic Tachometer, there was no instrument which would fulfill the conditions.

The accompanying illustration shows a cross-section of the instrument. The magnet (c) is carried by the ball bearing (b). The outside is threaded and ball bearing is secured by a spring washer, and can be turned only with a specially shaped wrench, as it is not intended to be moved except in our factory. In front of the magnet is a soft steel ring (d), which deflects the lines of force through the aluminum disk (g). This disk is mounted on a hardened steel shaft, and is supported by the jewels (j). On the outside edge of the aluminum disk are engraved the figures indicating the speed. Also attached to this shaft is a hair-spring (h), so adjusted that it resists the turning of the aluminum dial and brings it back to the zero point when the magnet is at rest. The jewel bearings and the steel ring are carried by the inner case (e), which telescopes into the outer case and can be removed at will. The inner case also serves the purpose of protecting the dial (g) from the air currents set up by the magnet when in revolution. Through both outer and inner case is an opening, covered by the glass (k), through which the figures on the aluminum dial can be read. Attached to the main shaft is the driving wheel, or disk (1), of proper diameter, having a hollow or gutter shaped periphery, into which is snapped a miniature rubber tire (m).

In this figure is also illustrated the arrangement of the poles on the permanent magnet. The lines of force flow from the north pole through the aluminum dial (g) to the steel plate, and back again through the dial to the south pole of the magnet (c).* When the magnet is revolved it sets up an induced or accessory action, in the dial (g), this action or rotation being in proportion to the speed of the magnet, and as the hair-spring is subject to the same law, it is evident that increasing the speed of the magnet will increase the displacement of the dial in exact proportion. The dial or scale can therefore be marked by equal divisions from the lowest to the highest reading. Since adjusting the magnet closer to the steel ring increases the torque, or induced rotation, it is only necessary to select a hair-spring of proper stiffness, revolve the magnet at a known speed, at the same time adjusting the ball bearing until the scale indicates the correct speed. The instrument will then be accurate over the entire range of the scale and will remain so permanently, there being no necessity for subsequent adjustment or recalibration. As there are no mechanical connections between the magnet and the indicating dial, and as the magnet runs very easily (there being always an abundance of power to drive it), there can no possible inaccuracy develop at this point.

To Owner
Cut Book 29
Page



Cross Section of Cut-Meter.

The indicating dial is mounted on a steel shaft, the points of which are hardened and supported in sapphire jewels, practically eliminating all friction or retardation. How perfectly this is accomplished can be judged from the fact that a change in speed of one-fifth of one per cent. is shown on the dial. It should not be thought that because this disk is mounted on jewels that the instrument is a delicate one requiring careful handling. Since the dial and shaft are very light, the strength of the jewels and pivot is very

great in comparison to the weight, and experience has shown that they will stand the regular service likely to be given in any ordinary machine shop. So certain are we of this point that we guarantee, for a period of one year, to repair free of cost any instrument returned to us, provided it has not been tampered with, and that the outer case is in a reasonably good state of preservation.

A complete full-size picture of the Cut-Meter is also shown. The instrument is sufficiently small and light so that it can be carried in the pocket without inconvenience. It presents a very handsome appearance, being substantially constructed of brass and nickel plated. The handle is turned from hard tropical wood and is highly polished.

The machine shop manager, who with one of these instruments tests every machine in his factory, will be surprised at the results and will be astonished at the great difference between what he supposed his cutting speeds to be, and what the instrument shows them actually to be. He will find in ninety per cent. of tests that working speeds are from twenty-five to fifty per cent. slower than they ought to be in order to obtain the most profitable results. If this same manager will purchase a Cut-Meter for every machine, and see that they are intelligently used, he will be more and more pleased and rewarded by the results obtained. A saving of only one per cent. would cover the entire cost of the installation of Cut-Meters in one year, and there would probably be a saving of twenty-five per cent.

The Cut-Meter is manufactured by the Warner Instrument Co., Beloit, Wis., and sold in Canada by the Fairbank Co.

THE FLAT TURRET LATHE.

During the present season an improved turret lathe has been placed on the market which should be of special interest to readers of this paper. This lathe is the development of fifty years of lathe manufacture. In 1891 the flat turret lathe was first introduced, and only recently a new form has been placed on the market which is the first flat turret lathe with cross sliding head. It was the first machine for rapidly doing general lathe work and the first machine for accurately turning long slender work without the use of centres.

It differs from all other lathes and turret lathes in the construction of these parts as follows: First—The headstock is mounted on guideways running across the machine instead of being affixed to the bed. It contains all the necessary gears and clutches for producing all of the changes of speed.

Second—The carriage carries a flat circular plate-shaped tool holder, from which the lathe takes its name of flat turret.

Third—The frame or bed is one single casting formed with guideways which run lengthwise for the carriage and crosswise for the headstock. The lower part of the bed casting serves as receptacle for chips and oil. The machine shown is the 3x36-inch size. It is shown arranged to handle full bars of stock up to 3 inches in diameter, turning pieces up to 36 inches in length. It may also be equipped for chuck work up to 14 inches in diameter.

Turret Description.

The turret is a flat circular plate; it is mounted on a low carriage containing controlling mechanism. The connection of the turret to the carriage and the carriage to the lathe bed are the most direct and rigid, affording absolute control of the cutting tools. The turret is accurately surfaced to its seat on the carriage by scraping and securely held down on the seat by angular gib

Cross Sliding Head.

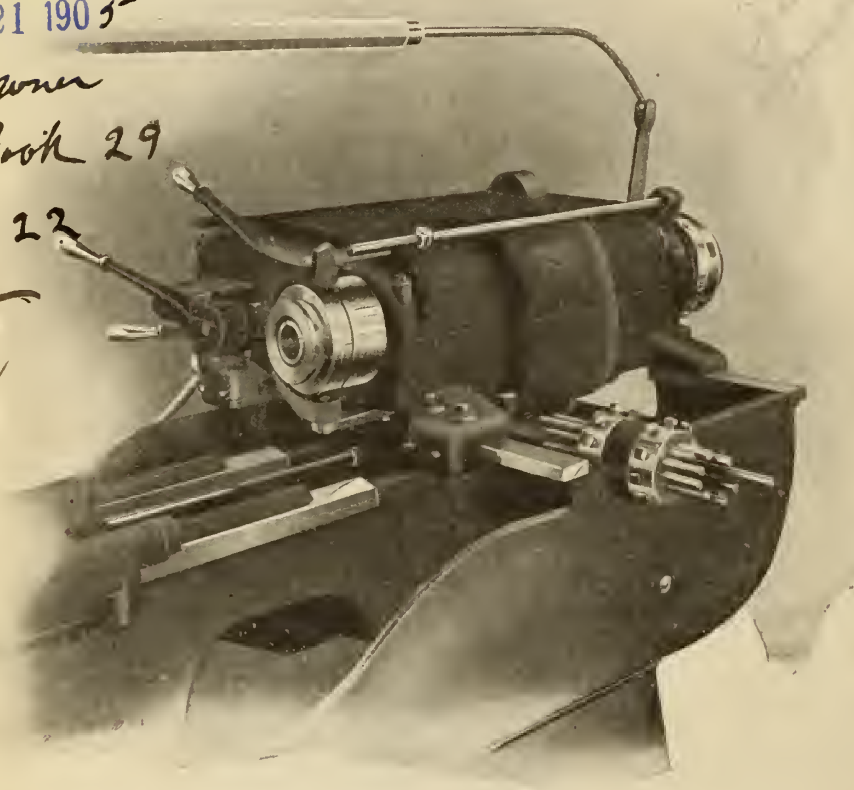
The distinctive feature of the original flat turret lathe was the flat plate-shaped tool holder from which it took its name. The original work holding headstock possessed many distinctive features, such as the automatic chuck and roller feed, but it contained the now nearly obsolete cone-pulley drive and back gear scheme. In the present machine is combined an ideal scheme of speed regulation with many other desirable features.

The cross feeding feature of the head grew out of a desire to get the best form of self-contained speed variator. After trying several combinations and positions it has been found best to arrange all the shafting and gearing in a horizontal plane so that the lower half of these running parts could be submerged in oil to insure perfect lubrication.

Chucking Lathe.

Just as the original flat turret lathe was the first machine to be equipped with an outfit of conveniently adjustable tools for bar work, so now with the present machine are provided a universal outfit of tools for chuck work. The ten stops for the cross feed head combined with the dozen stops for the turret and the turning and boring tools, all of the simplest and stiffest construction, make this machine ready to begin work as soon as it is supplied with the driving power.

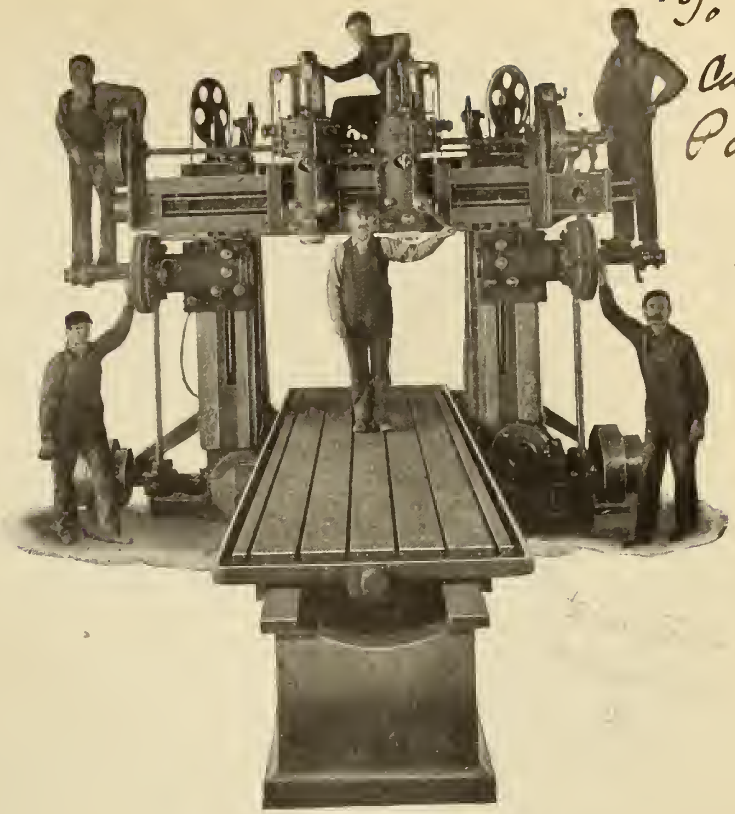
This machine is the product of the Jones and Lamson Machine Co., Springfield, Vermont.



Cross-Fed Mechanism.

HEAVY MILLING MACHINE.

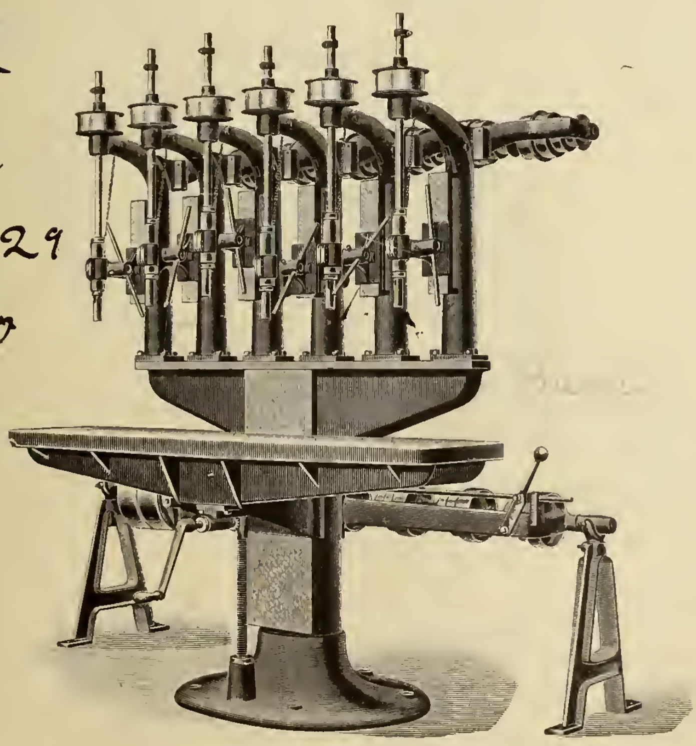
THE illustration shown herewith is a view of one of the heavy milling machines manufactured by the Ingersoll Milling Machine Co., Rockford, Ill., and its massiveness is at once discernable in comparing it with the workmen. There are various types of these machines manufactured, including horizontal spindles, double vertical spindles, three vertical spindles, or four head machines, and these are in use in most of the large manufacturing shops in the United States and other countries. Engine cylinders, or dynamo frames, are easily handled on these machines, and the work done is of a high order. It has been frequently said that the milling machine is more adapted for roughing work and not for finishing, but with these machines it has been proven that the work comes off as nearly accurate as it would come off any machine of any time, and in a great deal less time than the same pieces would come off the planer.



63-inch Four-Head Milling Machine.

MOTOR-DRIVEN SHAPER.

THE John Steptoe Shaper Co., Cincinnati, are manufacturers of a 25-inch back-geared crank shaper, which is driven by a $3\frac{1}{2}$ h.p. variable speed, reversible, Crocker-Wheeler motor, by means of a high-speed, silent-running, rocker-joint chain. The motor is mounted on an extension of the base



Six-Spindle Drill.

in the rear of the machine and the main switch and controller are conveniently located on the right-hand side of the machine, within easy reach of the operator as shown. The resistance box can be placed where desired, as it is entirely separate from the machine proper. The guard and cover of the chain were detached when the machine was photographed so the contact of the teeth in the chain and the teeth in the sprocket could be seen.

With the driving shaft of the machine running at 285 R.P.M., and the motor running at 1170 R.P.M., it is necessary to decrease the speed of the motor to about $\frac{1}{4}$ of the maximum speed, which is done by driving from a 15-toothed sprocket to a 61-toothed sprocket by means of the chain. By having the back-gear arrangement, which is operated by a lever in the back of the machine, it is possible to get any number of strokes between 6 1-3 strokes per minute and 44 strokes per minute, meaning the cutting tool will travel $12\frac{1}{2}$ ft. per minute minimum, to 91 ft. per minute maximum, which is an exceptionally large range of speeds.

The feed mechanism and crank for adjusting the length of stroke are easily accessible and can be adjusted by the operator from his position in front of the machine. An opening under the ram, or cutting bar, is large enough to admit shafts up to $3\frac{1}{2}$ in. in diameter or other work, but it is very useful especially in cutting key-ways. The top of the table measures 16 in. x 25 in., and is slotted on all three sides; can very easily be removed, allowing work to be fastened to the slotted apron to which the table is attached. The table has an automatic cross feed of $27\frac{1}{2}$ in., and a vertical adjustment of 14 in. The head is graduated and can be loosened and swiveled to any angle by pushing the lever at the back of the head, and can be instantly fastened by pulling the lever towards the operator. The tool head

has an adjustment of 9 in. All feeds are automatic and can be adjusted while the machine is in motion or at rest. The vise is graduated and can be swiveled to any angle desired The jaws are of steel measuring 2¼ in x 12 in., and can be separated to hold work up to 15 in.

FRACTIONAL SET-WORKS.

THE new double acting Fractional Set-Works issustrated in manufactured by The E. Long Mfg. Co., Orillia, and has all the necessary points to combine accuracy, simplicity, durability and ease of operation.

The set-works is composed of one solid cast frame, which is securely bolted to the carriage and keyed to the set shaft, making it very rigid. The ratchet wheel is made of cast steel, and is 12 inches in diameter, 3 inch face, with machine-cut teeth, assuring accuracy. The wheel is operated by four steel pawls, which extend full width of face. The pawls are held on face of wheel by steel springs, which obviate any lost motion by the slipping of the pawls. To eliminate any lost motion that may occur by the wear on ratchet wheel and pawls by long use, we have provided an adjustment for equalizing the pawl carriers.

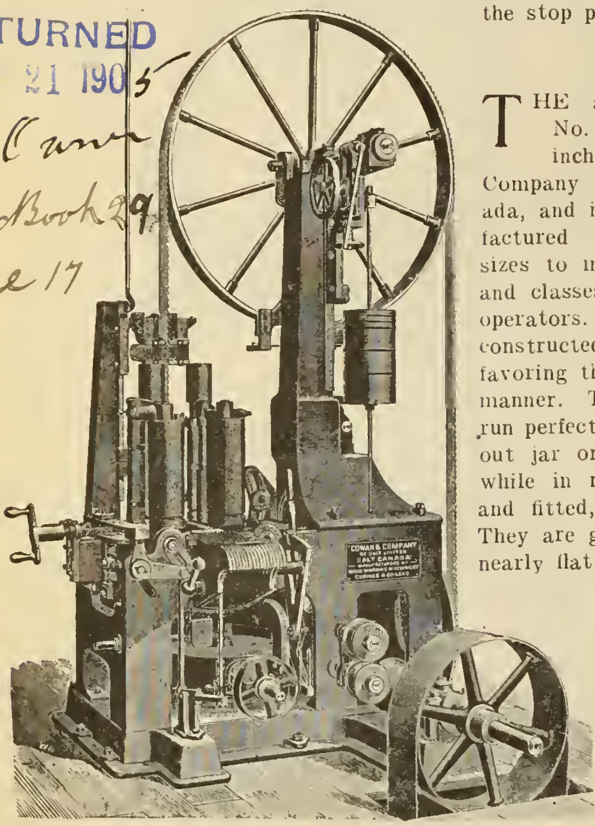
The pawls are released from the ratchet wheel by lifting the small lever shown in cut, while the knees are being receded, and are readily engaged again by shoving the lever down.

The quadrant which carries the stop pin is securely bolted to the ratchet frame, and the stop pins can be adjusted in the slots to cut any required thickness of board from ½ inch up to 2½ inches, graduated by sixteenths. The figures being on top they are easily read by the setter. For cutting different thicknesses it is only necessary to change the stop pin

Long Fractional Set-Works.

COWAN RE-SAW.

THE accompanying cut illustrates No. 0 band re-saw, M167, with 54 inch wheels, as made by Cowan & Company of Galt, Limited, Galt, Canada, and is only one of its class manufactured by this firm in six different sizes to meet the various requirements and classes of work required by mill operators. These machines have been constructed and designed with a view to favoring the saw blade in every possible manner. The wheels are nicely balanced, run perfectly true on their journals without jar or tremble, and thus the saw while in motion, if properly tensioned and fitted, will run without vibration. They are ground to a form which is as nearly flat as possible to give the requisite strain to the different portions of the saw blade and still retain it in its proper position, rendering it capable of withstanding the back thrust brought against it when re-sawing wide stock and necessitating but little hammering, consequently adding very materially to its life. In building this line of machinery the same general idea in many respects has been followed throughout. They all have good floor support, by reason of which they run steadily without any swaying motion or vibration, and being self-contained, all shafts remain constantly in perfect alignment. Great care and attention has been given to have all parts so proportioned as to throw less strain upon the saw blade. All unnecessary gearing has been dispensed with and the machine made as simple as possible. All worm gears, mitre gears, sliding feathers and, in short, those mechanical features which experience has shown to be undesirable and expensive to operate have been avoided. In bringing these machines to their present high state of perfection, the builders are indebted to their customers, whom it is their constant aim to serve satisfactorily, for much valuable information and suggestions regarding improvements to this class of machines, and they are always willing to give careful attention to any suggestions made by practical and experienced operators. These machines are made with wheels 42 in., 48 in., 54 in., and 60 in. diameter, with rolls to tilt so as to saw bevel or rigid if desired and have become extremely popular wherever placed.



54-inch Re-saw.

MAMMOTH AIR COMPRESSOR

PROBABLY twenty localtities, scattered over all parts of the world, claim for some one of their producing mines the distinction of being "the greatest gold mine in the world." The pride which makes this claim is doubtless pardonable, yet in all but one case it must suffer the fall which proverbially follows it. Perhaps nowhere are facts so hard to obtain as in mining operations. Yet the passing years have a way of sifting facts from fancies, and the highest authorities to-day unite in assigning to the great Homestake mine, at Lead, South Dakota, the first place among the gold mines of the world. Its monthly yield of the yellow metal averages in the neighborhood of $425,000, the value of over 2,000 ounces of fine gold. This is secured by the treatment of about 125,000 tons of ore per month.

Enormous Air Compressors.

As is eminently fitting, this greatest mine in the world has in its power plant the largest air compressor in the world, and this giant must receive the first mention in the list of machines on the Homestake lode. It is located at the Ellison shaft and is a cross compound condensing two-edge Corliss machine, built by the Ingersoll-Sergeant Drill Co., of New York. The high and low pressure steam cylinders have a diameter of 32 and 60 inches, respectively, the air cylinders are 52 1-4 and 32 1-4 inches, in diameter, the stroke is 72 inches. At rated speed of 50 R.P.M. the free air capacity is 9,000 cubic feet per minute, this volume being sufficient, under average conditions of mine work, to operate 125 rock drills. The steam pressure is about 130 pounds. The exhaust steam is received by a Wheeler surface condenser, in connection with a cooling tower. The well-known Ingersoll-Sergeant piston inlet valve is used on both high and low pressure air cylinders, between which a horizontal intercooler is placed in the air circuit. The total weight of this huge compressor with its accessories, is about 300 tons. It is placed beside the great Ellison hoist, the mountain being blasted out to make space for the engine room.

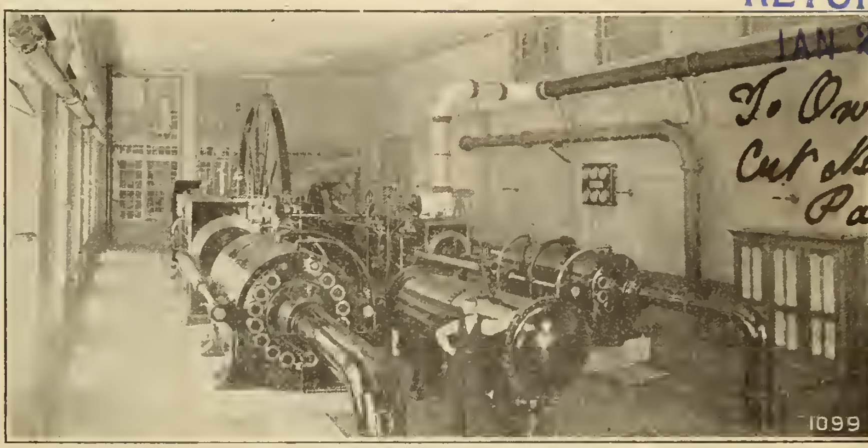
The output of this great machine is used exclusively for operating machine drills in the underground workings and it is assisted by two smaller machines, built by the same maker and both of Corliss type, with piston inlet valve. One of these machines, located at what is known as the Old Abe shaft, is a duplex machine, with steam cylinders 24 inches in diameter, air cylinders 26 1-4 inches and a stroke of 60 inches. Its capacity in free air is about 4,400 cubic feet per minute. The other compressor is at the Highland shaft and is of the same type as that just described. Its stroke is 42 inches, air cylinders are 22 1-4 inches steam cylinders 20 inches in diameter. At rated speed its free air capacity is about 2,500 cubic feet per minute. These two compressors, together with the giant at the Ellison shaft, are operating over two hundred Ingersoll-Sergeant rock drills in the mine workings.

A Small Compressor.

In the hoist room at the Ellison shaft, not far from the largest compressor, is installed a small Ingersoll-Sergeant class "GC" compressor, with duplex steam cylinders and two-stage air end. This is one of the smallest machines equipped with the piston inlet valve and the contrast between it and the large machine adjacent is striking. The smaller machine has a stroke of 12 inches, its steam cylinders are 10 inches in diameter, high pressure air cylinder 10 1-4 inches diameter, low pressure 16 1-4 inches. At rated speed of 160 R.P.M. the piston displacement is 444 cubic feet of free air per minute. The air from this compressor is used in the cylinders controlling the starting, stopping, reversing and braking of the Ellison hoist. In this engine room is located a straight-line high pressure compressor of the same make furnishing air at 900 pounds pressure to charge the storage tanks of a locomotive used in hauling ore cars between shafts and mills in the surface workings.

For various purposes in the mills and surface workings, two other air compressors of Ingersoll-Sergeant make are installed. These are both of Corliss type, with piston inlet valves. The sizes of these machines are 12 and 16 1-4 inches, with 36 inch stroke, duplex type, and 12 and 18 1-4 inches by 36 inches, half duplex. Their combined capacity in free air is about 2,100 cubic feet of free air per minute.

The air compressor installation of the Homestake mine, just described, is but one branch of the elaborate system of labor-saving and cost-reducing machinery which has made this the greatest gold mine in the world. The policy of the management has from the first been one of broad-minded recognition of the value of smal leconomies. The best engineering skill has been employed in the application of the highest class of machinery to the various processes of mining and milling. Not the cheapest machinery, but the best and most economical, has always been selected, the increased investment being always justified by later savings. The air plant briefly outlined above is representative of the development of this policy.



Homestake Mine Air Compressor.

JONES & MOORE BUSY.

Among the contracts the Jones & Moore Electric Co., Limited, are now working on are, an electric motor and electric plating dynamo for W. J. Cummings, Winnipeg; an electric generator for the Page-Hersey Iron and Tube Co., Guelph, Ont.; an electric lighting plant for the McCann Milling Co., Toronto; two 500 light dynamos, direct connected to Robb engines for the W. A. Murray Co., Toronto. The firm have also just completed the installation of a complete electric lighting plant for the Stratford Chair Co., Stratford, Ont.

Power and Transmission

Steam. Gas. Electricity. Compressed Air. Water.

BELL TELEPHONE POWER PLANT.

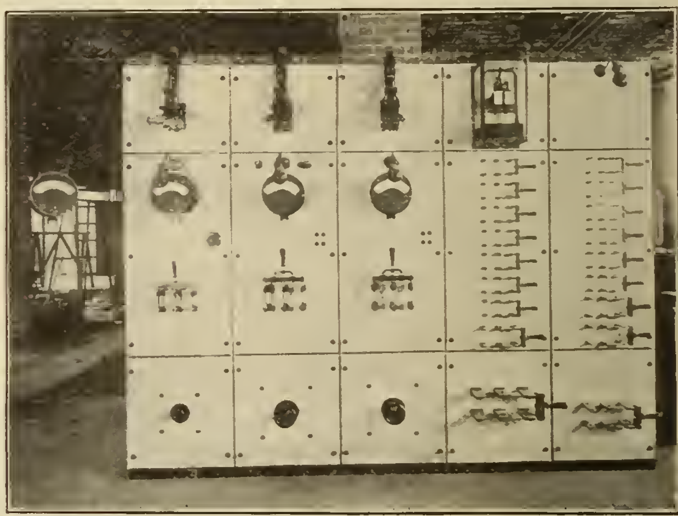
Despite the fact that there are three great water-power developments for generating electrical energy in the vicinity of Montreal, many firms and institutions find it convenient and economical to install their own power plants. The question of power for large buildings in Montreal is getting to be a very important one. The price of electric current for power and lighting purposes, is high, and it is found that for plants of one hundred h.p. and more, it is cheaper to put in a plant than to purchase energy from outside. This is due largely to the fact that considerable steam is required for heating the buildings; and if the demand for steam for heating exceeds the amount required for power purposes, the power will cost nothing for five or six months in the year.

In considering the requirements of an isolated plant for a large building it is necessary to ascertain beforehand, as nearly as possible, what the probable demand for power will be throughout the day, that is, to get a load curve from which the size of the generating units may be determined. These units should be of such size that they will always operate at an economical load. In the case of this plant, the probable mean load curves could be determined fairly accurately for the reason that the new building is about the same size as the old one and they have approximately the same number of lights, so that the heating, elevator and lighting requirements are about the same in the two cases. Power is supplied by two fifty k. w. machines, and one seventeen and a half. The latter machine will be started in the evening

charging and that due to lighting, closer together, and so decrease the time of running of the larger unit.

In the design of this plant one point that had to be kept in mind was that continuous operation was essential on account of the telephone exchange, as it would be impossible to shut it down for even five minutes. To eliminate the possibilities of an interruption in the service, several precautions were taken. There are three boilers, any two of which can do the work; two 50 k. w. and one 17½ k. w. machine, any two of which can handle the maximum load. There is a ring system of steam piping, with the valves so arranged that should a break occur at any point whatsoever in the steam pipe, it would still be possible to run two boilers and two engines in any case. As a further precaution, the switch-board is arranged

New Installation.



Switch Board.

The Bell Telephone Co. have recently erected a large new building adjoining their old one, and the power plant just completed embodies features of special interest. In laying out the plant it was important to make as much use of the old material and apparatus as possible, and to connect the old and new plants in the most efficient way. In this building the steam required for power purposes is only slightly in excess of the amount required for heat, so that the coal consumption during the winter months is not much larger with the power plant than without it.

about seven or eight o'clock, after the heavy lighting load is over, and will run until nine or nine thirty in the morning, when the charging of the batteries for the telephone exchanges will be commenced. This charging current will bring the total load up to about fifty kilowatts, and one of the large units will be started to carry it. This machine will be run throughout the day carrying the heavy lighting load in the afternoon. It is probable that in operation the charging will take place somewhat later in the day to bring the two peaks of the loads, namely, that due to

with two sets of bus bars, one to be connected to bear outside sources of power, thus rendering the possibility of a shut-down almost out of the question.

The mechanical plant may be divided up into that belonging to the old building and that belonging to the new. In the old plant there are two B. & W. boilers, having a heating surface of 1,265 sq. ft. each. The new boiler is of the same size. The old elevator plant consists of two cars, three feet six, by five feet six inches. The new elevators were installed by the Otis Elevator Co., and the cars are 5 ft. x 5 ft. 6 in. de-

signed to run at a speed of 100 ft. per minute under a load of twenty-five hundred pounds. They are driven by duplex pumps, steam cylinders 12 and 18 inches, and 9 in. water cylinder with a stroke of 10 in. A feature of this equipment is the small space it occupies, the rams which have 24 in. cylinders and 9 ft. stroke are mounted one above the other, and the pressure tank is placed above the discharge tank with its pump directly beside the latter, so that the floor space occupied is a minimum. The machinery in the new power plant proper consists of the three generators mentioned before installed by the Canadian Westinghouse Co., and direct connection to Robb & Armstrong engines. The generators are of the engine type, 125 volt direct current machines. The two 50 k. w. units run at 275 revolutions per minute. These machines are direct connected to 12 x 12 in. simple horizontal engines. The $17\frac{1}{2}$ k. w. generator runs at 375 revolutions per minute, and is directly connected to an 8x8 in. engine. The engines are designed for working pressure of eighty pounds, but allowance has been made to increase the pressure to 125 lbs. if it is found desirable. The generators are connected to the switch-board by leads running in conduits under the floor. The switch-board consists of three generator and two feeder panels, so arranged that an extra generator or feeder panel can be added without disturbing the others. An unusual feature of this switch-board, as can be seen from the illustration, is that it is provided with a double set of bus bars and double-throw switches to the various circuits. One of these sets of bus bars is connected to the machines through the three-pole switches shown. The other set of bus bars may be connected to another source of power by means of the large 800 ampere switch. The board is so arranged that current may be either given to or received from the outside circuit.

Under ordinary circumstances the gases from the boilers are taken away through a 4 ft. stack. There is also an induced draught fan capable of handling the gases from the three boilers and of maintaining a draught in the main breaching equal to a water pressure of $1\frac{3}{4}$ inches. The fan has a blast wheel 60 in. in diameter, and is driven by a 6 in. vertical engine. This fan is placed on a bye-pass so that the gases from the boilers can go directly to the chimney or through the fan. To avoid any possibility of the feed water supply being shut off from the boilers, the pipes are arranged in the loop system as in the case of the steam pipes. From the pumps the water passes through an oil filter that extracts all the oil before it is received into feed water heater. It will be seen from the foregoing that this plant was designed with a view to continuous service, and from the manner in which the installation has been effected, there seems little possibility of any interruption occurring.

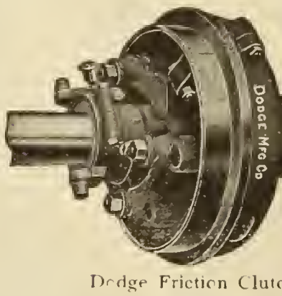
A test of the plant was made recently, the duration of which was nine hours. The coal used was pea anthracite. There were two boilers under steam, the first furnishing steam, one for the heating of the building and for the auxiliary plant, consisting of elevators, feed pumps and the ventilating fans. The second furnished steam to the 50 k. w. unit and to the $17\frac{1}{2}$ k.w. unit. It was found that the coal consumption per hour in boiler No. 1 was 200 lbs. and in boiler No. 2, 472 lbs., and the water evaporated per pound of coal by meter, 8.26 lbs. The average steam pressure was 79 lbs. per square inch, and the average kilowatts of the two units, was 58.8. The steam per k. w. hour was 66.3 lbs. and per I.H.P per hour, 36.4 lbs. The coal per k. w. hour was 8.03 lbs. and per I.H.P. was 4.41 lbs. The compound efficiency of the $17\frac{1}{2}$ k.w. unit, that is, the electrical horse power, divided by the indicated horse power, was 67.5 per cent., and the compound efficiency of the larger unit was 75.6 per cent.

The plant was designed by E. G. M. Cape, consulting engineer of Montreal, who introduced the special features and supervised the installation.

THE UTILITY OF THE FRICTION CLUTCH MECHANISM.

THE special function of the friction clutch pulley is that it should be a positive or driving pulley when "engaged," and to be an idle or loose pulley when "disengaged," the engaging or disengaging meaning the simple shifting of a lever, the shafting all the while running at its regular speed. In friction clutch pulleys like ordinary pulleys, there are driving pulleys and driven pulleys. In the case of a friction clutch driving pulley, when "thrown-out" or disengaged, the sleeve and pulley, and consequently the belt and all it may be driving, stops, the shaft and the positive side of the clutch only, runs, but if the clutch pulley is a driven pulley, when disengaged the belt and pulley continue running, and the shaft and all connections past this point stands still. This is just what is accomplished with a tight and loose pulley and a shifting belt, but this shifting belt is what every power user is anxious to avoid, especially when the belt exceeds 6 inches in width.

The belt shifter is responsible for a very considerable proportion of the belting bills, and in the case of throwing belts on and off, how many men have been killed, and how many maimed for life? We could hardly answer, but we all know that every now and then we read of some such appalling accident, through some employe trying to throw on a belt. If for no other reason this danger itself should be sufficient to cause every power user to abolish the practice of throwing off and on belts in his shop, and adopt the friction clutch pulley. Then by simply throwing in or out a lever his pulley runs or stands still as he pleases. Then again where power is an item, the friction clutch pulley, also the clutch coupling are almost indispensable, as such parts of portions as are not in actual use may be cut off instantaneously, or immediately started up again without any reference to or communication with the motive power. The friction clutch pulley is becoming very popular for driving dynamos for factory lighting. This machine usually is located in the engine room, and as it is only required for a few hours per day, and at certain seasons, a clutch pulley



Dodge Friction Clutch.

which may be started or stopped as required is really the only practical way of driving a belted machine. The shafting in most modern shops now-a-days is fitted with one or more friction couplings In this way one-quarter or a half of a shop may be shut down instantly or started up instantly without stopping the engine, and such stops are not infrequent in some shops. The cost of a five minutes' stop where 200 men are working costs not only the three or four dollars in wages, but it also costs the profits which are not being earned during that stop, in most cases one such stop will pay the interest for a year on the cost of a friction clutch! How many factories in Ontario stop two or three minutes every day to throw a belt on. Every factory has use for friction clutches to a greater or lesser extent. They are time savers, belt savers, life savers, and space savers, also power savers.

The mechanism illustrated is made by the Dodge Mfg. Co., Limited, Toronto

FEED PUMP AND JET CONDENSER.

THE feed pump and jet condenser illustrated are of Canadian manufacture and embody special features.

The base of the pump is cast hollow forming a suction chamber to which the suction pipe may be attached on either side. The steam and water cylinders are both attached to this base and both overhang. This arrangement permits the cylinders to be removed for inspection or for repairs. The water cylinder lining, valves and seats, rod box, glands, nuts, etc., are brass. The piston rods are Tobin bronze or Muntz metal. These metals will neither tarnish nor corrode. All the regular lines of pumps have these in and do not cost extra. The pump cylinders are provided with a removable brass lining that can easily be taken out for reboring or exchange. The pump is self-contained, thus obviating the ne-

Feed Pump.

Independent Air Pump and Jet Condenser.

cessity for a large and expensive foundation. After the pumps are tested at the works they are properly packed and shipped ready to connect at once as soon as they arrive at their destination.

The other illustration shows an independent air pump and jet condenser. The exhaust steam from main engines, pumps, etc., is admitted into the top of the condenser, and on its descent is met by a fine spray of cold water coming in the opposite direction through a spray pipe. By this process a complete mechanical mixture of the steam and injection water is obtained. A vacuum is thus formed by the water depriving the steam of nearly all its latent heat and condensing it. The air pump removes the condensed steam from the condenser, the action being continuous. An automatic vacuum breaking device is provided, consisting of a copper float and valve opening to the atmosphere.

Where water is available a great saving of fuel or corresponding increase of power can be obtained by the use of one of these condensers. It is a well known fact that the atmospheric resistance, together with the back pressure in exhaust passages and pipes, is so much power taken from the steam on the engine piston. When the steam in an ordinary non-condensing or high pressure engine has performed its work in the cylinder, it is ejected into the atmosphere against atmospheric pressure, usually reckoned at 15 lbs. to the square inch.

The work of the condenser is to remove this back pressure and form a constant vacuum, equal to 13 or 14 lbs. per square inch, on the exhaust side of the piston and the steam can consequently be expanded to nearly the absolute zero of pressure, thereby obtaining its full expansive power. The use of a condenser will therefore cause a saving of from 20 to 25 per cent. or increase the power from 20 to 25 per cent.

An independent air pump and condenser has an advantage over a direct connected or belted air pump as it can be started and vacuum obtained before the engine is started.

Another advantage with this condenser is that when a close heater of any pattern is already located, it need not be discarded, as it will act as a surface condenser between the engine and independent condenser and increase the temperature of the feed water so it can be returned to the boiler at a temperature of about 130 degrees. A single condenser can be used for two or more engines, pumps, etc., one or all of which may be stopped without interfering with the action of the condenser. This condenser will work as well with marine engines as with stationary, and it can be used as an independent bilge pump when necessary. No steam pump is required to lift its injection water. It will lift from any point that can be reached by pumps in general use. The water cylinder lining, stuffing boxes, gland and nuts are brass. The piston rod is Muntz metal. The valve seats are brass but the valves are rubber with brass springs.

The Goldie & McCulloch Co., Limited, manufacturers of the above, issue an interesting catalogue of both these pumps and condensers and would no employes of the Belgian glass manufac- doubt be pleased to send these to anyone interested.

SAVING OF OIL BY FILTRATION.

IN every engine room, and in every factory and mill, where a large amount of machinery and long lines of shafting are in operation, there is a great waste of lubricating oil, owing to the fact that in many cases no provision is made for catching the oil after it passes through the shaft or engine bearings. This is often due to the style of

bearing used on the shaft line, but where suitable self-oiling bearings are installed, and provision made for catching the drippings which accumulate in the drip cups, or where provision is made for catching the oil after passing through the engine bearings, and then provision made for purifying these drippings through an oil filter, a great saving is effected. The manager who has not been in the habit of saving in this direction, has lost a desirable point in workshop economy.

Every engineer appreciates the value of good oil, and asks his employer to provide the best in the market, for lubricating purposes, and for the purpose of preserving machinery in his care. When a good grade of oil is supplied there is all the greater reason for filtering it, and filtering devices on the market should receive consideration at the hands of factory superintendents.

APPLICATION OF ELECTRICITY TO RAILROADS.

AT the International Electrical Congress, B. J. Arnold expressed his belief in connection with the application of electricity to steam railroads, that electricity will be generally used on all the main railroad terminals and ultimately on the main through lines for passenger and freight service. He does not anticipate that it will always be adopted on the grounds of economy of operation, or that it will come rapidly or through the voluntary acts of the owners of steam railroads, except in special instances. At first the terminals will be equipped for special reasons, due either to the voluntary act on the part of the terminal company to effect economy in operation, or to public pressure brought to bear upon the owners through an increased demand on the part of the public for better service, on the ground that the use of the steam locomotive is objectionable in our great cities.

Trunk Lines Electric.

Roads which run through populous countries will either build new roads or acquire for their own protection those electric railroads already built and operating in competition with them and utilize them as feeders to their through-line steam trains. Thus the steam railroad companies will gradually become interested in electric railways and eventually become the real owners of them. With these roads operating as feeders to the main-line system and with the terminals thus equipped and the public educated to the advantages of riding in electrically equipped cars, the next step will logically be the electrical equipment of the trunk lines between the cities already having electrical terminals. Thus a favorably located trunk line having a sufficient density of population will feel warranted in equipping electrically, and when this is once done the other roads running between the same competing points must sooner or later follow in order to hold their passenger traffic.

Acquiring Freight Service.

With the terminals and main lines equipped electrically and the desire on the part of the public for more prompt and efficient freight service resembling that which is given by the steam roads in England and on the Continent, due to the great density of population, there will be developed a great high-class freight service conducted in light, swiftly moving electric trains which can be quickly divided and distributed over all surface tracks of our smaller cities or through underground systems similar to that which is now being built in Chicago. This class of freight service would soon prove as large a part of the freight traffic of a road that the operation of the through-freight traffic by steam locomotives, though at present cheaper, would in time, as the cost of coal increases, grow less until those roads operating an electric passenger service would ultimately use electricity exclusively.

This is an important matter and one that large railroad companies are considering more and more. When there is a train service calling for a large number of trains, such as a suburban line, electricity has been found far ahead of steam, both in economy of installation and operation. The long distance problem has not yet been solved, but when a system has been devised that embodies the effective use of the high pressure transmission and safety in operation, it will become an active issue in Canadian railroads where water power for electric generation is to be had in such abundance.

A BRIGHTLY LIGHTED FACTORY.

ANYONE going along Ontario street east, in Montreal between four thirty and six in the evening, cannot fail being struck by the bright appearance of a large building situated just north of the corner of Joanne d'Arc street. The view from the exterior is rather inviting, and on entering the visitor's favorable impression is increased rather than diminished. It is the factory of the Acme Can Works, whose progressive policy is well known, and who have recently shown commendable enterprise in installing their own system of gas lighting. That it is a success is told at a glance, as every nook and corner of the spacious main building both upstairs and down is well illuminated. The management of the company are enthusiastic over the good results obtained, not only in additional light but in a saving of several thousand dollars a year as well.

The gas is generated from crude petroleum, brought to the works in tank cars and stored in a 6,000 gallon tank buried in the ground at some distance from the building. Close to the building, and likewise covered in, a 250 gallon tank is placed. Thus any great fire danger that might otherwise be incurred is done away with, and the immediate supply is obtained from the smaller tank. It is then pumped to the gas generator. The generator consists of six metal tanks about two feet in diameter, and nine feet high, connected in series. Into the first of these air is pumped and heated to a temperature of 120 deg. at 1 lb. pressure. It is sent through the next two in turn each of which contains a quantity of the crude oil, supplied from the pump below. The four other tanks are fitted with compartments containing perforated zinc and fine wire gauze. Through these the oil saturated air or gas passes, emerging from the last into the main a high quality of dry illuminating gas. Only when there is a demand upon the generator is any gas made. One feature of this gas is that it requires a Bunsen or other special form of burner, and will not light from an ordinary gas jet. Bunsen burners and ordinary gas mantles are used, and a very bright, intense white light is the result.

GAS PLANT ECONOMICS.

RECENTLY considerable data has been collected by one of the engineers of Power and Mining Machinery Co. relating to the subject of the relative cost of power by steam production and by producer gas. Taking an average of a great many plants in operation, it was found that the cost of fuel in a steam plant, operating ten hours per day, was $146.02, being 33.96 tons of coal at $4.30 a ton. In the case of gas engines and producer gas, 7.72 tons of coal were consumed, which at $4.30 a ton amounts to $33.19, which means a saving per day of $112.83, and an annual saving of $41,-182.95. Another strong point brought out in favor of the gas producers, was that they could be used on hard or soft coal, wood, or coke, the change being made without any interruption.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

PLANS have been prepared by Parr & Fee, of Vancouver, for the erection of a $40,000 business block in that city.

The foundry of the Canadian Copper Co., Copper Cliff, has been burned.

The Canadian Rubber Co., of Montreal, is opening a branch in Calgary.

The town of Walkerville, Ont., is to have a new school house costing $50,000.

Gas has been struck at the Northwest Gas and Oil Company's well near Edmonton.

The assets of the Maisonneuve Engine Works, Montreal (Maisonneuve), have been sold.

A new saw mill with a daily capacity of 25,000 feet is to be erected at La Valle, Ont.

A steel and concrete bridge is to be built across the Sydenham River at Owen Sound.

Acadia Power Co., manufacturers, Halifax, have suffered loss to premises by explosion.

E. W. Rathbun has registered as president of the Canadian Portland Cement Co., Montreal.

The wood working factory owned by Wm. Currie & Co., Campbellton, N.B., has been burned.

A church costing over $100,000, will be erected by the Roman Catholics in Winnipeg, shortly.

The assets of Authier & Charette, saw mill owners, La Macaze, have been sold to Pariseau Frere.

Moore & Whittington, contractors of Victoria, B.C., are to erect a sawmill of 10,000 feet daily capacity.

The Alberta Railway and Irrigation Co. is seeking power to acquire the Western Alberta Railway.

The Buck Stove Co., of Brantford, Ont., purpose enlarging their foundry building early next Spring.

The Peat Coal Co., of Canada, Limited, St. Johns, is in liquidation; Chas. Arpin is provisional liquidator.

The McAdamite Metal Co., of Staten Island, New York, intend opening a branch in St. John, New Brunswick.

The defunct Northrop Iron Works, Valleyfield, Que., are to be started in a few days by the Fairbanks Scale Mfg. Co.

Thos. Kelly, of Winnipeg, has received the contract for the construction of the Winnipeg post-office, at about $528,000.

The Cramp Steel Company, Limited, has been reorganized and is now known as the Northern Iron and Steel Company, Limited.

By a vote of 422 to 46 the people of Calgary decided in favor of installing a municipal electric lighting plant in that city.

The coal output at the collieries of the Crow's Nest Pass Coal Co. for the month of November was 74,569 tons, the largest on record.

Montreal Rolling Mills, Montreal, have purchased property with the intention of extending their buildings along the Lachine canal.

Wallaceburg Electric Light Co., Wallaceburg, have been succeeded by the Premier Electric Light and Power Co., Wallaceburg, Ont.

The Standard Ideal Sanitary Co., Port Hope, Ont., the Canadian manufacturers of enamelled plumbing ware, have doubled their capacity.

It is rumored that Mr. Whitney, the owner of the copper smelting plant at Pictou, has sold the property to a syndicate of American capitalists.

On January 2nd, the freeholders of Milton voted on a by-law to provide for the purchase of the plant of the Milton Electric Light and Power Co.

Haines Bros., New York, have received the contract for building the road of the Hamilton, Ancaster and Brantford Electric Railway Company.

Reinke & Boland, owners of the Dominion Planing Mills at Eganville, Ont., intend to greatly increase their amount of wood working machinery.

The Niagara-Welland Power Co. are asking for power to build a tramway along its right of way, and for an extension of time to complete works.

The Humphries Mfg. Co., of Mansfield, Ohio, manufacturers of pumps, enamelware and brass goods, intend establishing a branch at Sarnia, Ont.

Negotiations between the town of Fort William and the C.N.R. for the location of the Atikokan Iron Company at Fort William, are practically completed.

Petroleum and coal have been discovered near Chambord Junction, Quebec. Both the class of coal and petroleum found are said to be of the first order.

A splendid flow of gas has been struck on the premises of Goold, Shapley & Muir Co., Brantford. Drilling operations have been going on for some time.

English capitalists are coming to Vancouver for the purpose of looking over the ground with the view to the establishment of a new steel plan on the coast.

Grant & Harrison, architects, Vancouver, are busily engaged preparing plans for the erection of several large business houses in that city, in the near future.

The Waterous Co., will install the machinery in four sawmills in British Columbia, one at Peachland, another at White Horse, at Kamloops, and another in the interior.

The latest sensation in the Kootenays is the finding of ore giving values ranging from 160 to 240 ounces silver and from $10 to $60 per ton gold, with three per cent. copper.

Incorporation is asked for a railway running from a point on the C.P.R. between Woodstock and London, to St. Mary's and thence west through Perth and Lambton to Lake Huron.

Revenue from timber sources, judged by the returns to the present, will be nearly $365,000 for the fiscal year ending next June 30. Last year they were $250,000, the highest on record.

The first zinc smelter to be erected in Canada will be built at Frank, Alberta. C. Fernan who is the promoter of the undertaking, states that the work of construction will be begun at once.

Allis-Chalmers & Co., architects, of Milwaukee, have prepared plans for the construction of a flour mill with a capacity of 5,000 barrels for the Keewatin Flour Mills Co., at Winnipeg.

Geo. Goodwin signed the contract for the erection of the National Museum at Ottawa, on December 28. The new structure will cost $990,000, and will not be completed for three and a half years.

The Rossland Board of Trade is to petition the Dominion Government for a bonus on copper, similar to that given to lead and iron, and which has proven such a stimulus to the latter industries.

Among the large buildings to be erected in Montreal this year are the Mount Royal Club, the McGill Union, Alexandra Hospital, Eastern Townships' Bank, Birks' building and the Lindsay building.

During the year 1904 there was brought from Nova Scotia, by way of the St. Lawrence River, 1,391,592 net tons of coal as compared with 1,061,287 net tons in 1903, an increase of 330,305 net tons.

The plant of the Imperial Steel and Wire Company of Collingwood, Ont., has been put into commission. The company have enough orders on its books to keep the machinery running till the end of next May.

The Midland Railway, running between Truro and Windsor, Nova Scotia, has been sold to the Dominion Atlantic Railway, which will take possession on January 1st. The purchase price was $1,250,000.

The Kingston Locomotive Works Co. have received an order for ten mogul passenger engines for the Canadian Pacific Railway Co. The engines will weigh 195,000 lbs each and the tenders 126,000 lbs each.

The rebuilding of the factory of the Canada Carriage Co., Brockville, Ont., which was recently destroyed by fire, will create a big demand for wood-working machinery. The loss was $300,000; insurance $200,000.

The coal shipments of Nova Scotia this year amount to a total of 4,367,000 tons. This amount is from six collieries. Unless the others produce among them 325,000 tons the yield of 1904 will be lower than that of 1903.

Brooks-Smith Hardware, Limited, Toronto, share capital $75,000; purpose to manufacture and sell hardware, mantels, grates, tiles, implements and machinery. The directors are: E. J. Creeper, J. Brooks, W. M. Smith, W.

Brooks, W. H. Carrie, and H. Symons, all of Toronto.

The Canadian Straw Fuel Machine Co., Winnipeg, contemplate putting on the market a machine to compress the straw which the farmers are burning year after year as waste product, into what is called "straw wood."

A despatch from Sydney says the blast furnace of the Nova Scotia Coal and Steel Co., at Sydney Mines, N.S., is chilled, and as a result the production of pig iron is stopped. It will cause considerable loss to the company.

Pennsylvania, which makes more than half the iron used in the United States, produces less than 2 per cent. of the iron ore mined. Ohio, which comes next to Pennsylvania as an iron-maker, mines less than 0.1 per cent. of the total.

The Montreal Terminal Railway is seeking power to build an electric railway in the counties of Hochelaga, Maisonneuve, Jacques Cartier, Chambly, Vercheres, Laprairie, St. John's, Iberville, Rouville and St. Hyacinthe.

Early next year a new mill will be erected at Atwood, Ont., by W. F. Forrest, in which will be installed sufficient power to furnish the town with electric light. The new mill will be thoroughly equipped with all modern machinery.

Donald Fraser & Sons, Fredericton, N.B., have decided to erect two new shingle mills, one at Cabineau, to have fourteen shingle machines, and the other at Baker Brook, on the St. John River, which is to have ten shingle machines.

An important mining deal has gone through at Salmo, South Nelson, B.C., whereby the Kootenay Bell group of mineral claims has been bonded by Patrick Clark, the millionaire mining operator of Spokane, for a hundred thousand dollars.

A new undercutting and shearing machine is being tried, in the Reserve mine, by the Rand Drill Co.'s engineer, Mr. Cotton. It is said to have given excellent results. It is in appearance something like a large rock drill.—Mining Record, Dec. 28.

W. Smith, of Goderich, Ont., manufacturer of furniture, has placed a boiler and engine in his manufacturing department. He purposes installing a number of wood-working machines for doing fancy scroll sawing, machine carving, burned work, etc.

There will be a new illuminating light company in the New Brunswick field very shortly. A company has been organized in Sydney, N.S., by H. E. Cook, of Boston, which has purchased the charter issued to the New Brunswick Gas and Power Co.

The Canadian Corundum Wheel Co., of Hamilton, is enlarging its premises with the intention of starting a new industry. This new industry is the vitrifying of emery wheels. Goods of this sort to the value of $25,000 were imported last year. This is the first manufacturing plant of its kind in Canada.

The Imperial Varnish & Color Co., Limited, are distributing amongst their friends an aluminum pocket comb enclosed in a neat little leather case. It is very handy for the pocket and no doubt the Imperial Varnish Co. will be pleased to send one to any one inquiring.

Hon. R. G. Tatlow, Vancouver, is looking after the interests of the Pacific Coast Power and Pulp Co., an English concern, capitalized at $2,000,000 and holding limits and excellent waterpower 80 miles north of Vancouver.

The measures of the Breckenridge & Lund Coal Co., located at Lunbrek, in the Crow's Nest Pass district, are to be opened up on a larger scale. Funds have been secured for the purchase of machinery capable of taking out 500 tons per day. At present the market is only local.

The rolling mills and plant of the Iron and Steel Company of Canada, Belleville, Ont., which were offered for sale by public auction, were bought in on a reserve bid. Only two bids were made, one of $25,000, made by M. Sessenwein, of Montreal, and another of $50,000, made by H. Corby, of Belleville.

Exhaustive tests made on fine clay found near Vancouver show it to be equal, if not superior to any found on the continent or imported. Pellew-Harvey, Bryant & Gilman, of Vancouver, have placed an order for machinery for a plant to manufacture firebrick and the construction of a factory is being hurried forward.

The Fundy Coal Co., Limited, is applying for a charter for a company to acquire and operate the Atlantic Grindstone Co.'s quarries as well as the coal mines. The output of grindstones is very considerable and the tonnage of the coal mines is gradually increasing. The two companies are controlled by the same interests.

The Temiskaming Railway, the Michigan Central, Pere Marquette Railway Toronto, Hamilton and Buffalo will each require around 10,000 tons. The Intercolonial Railway, owned by the Government, will need 25,000, but a good portion of it may go to the Dominion Iron and Steel Company. The Soo mill is sure of 10,000 tons.

The directors of the Rossland-Kootenay Mining Co, Limited, have issued their report and account for the year ending August 31st last. Owing to the difficulty of obtaining satisfactory rates from the smelters, the shipments of ore during the year were greatly restricted. The profit and loss account shows a credit balance of £8,898.

The first annual general meeting of the Mexican Light and Power Co. was held in Montreal, December 21st. The company have already made a sufficient number of contracts to dispose of all their power. The earnings for last year amounted to $380,000, an increase over any previous year. The old board of directors were re-elected.

McGregor, Gourlay & Co., of Galt, Ont., have shipped some large machinery to British Columbia. There is a planer for the Sayward Mills at Victoria, pieces for the B. C. Electric Railway shops at New Westminster, a planer for the Rat Portage Co.'s mills at Vancouver, some for the Hastings Mills, and other pieces. The machinery is now being unloaded.

From the monthly statements of pig iron produced this year, that for December being estimated somewhat larger than for November, the total will be about 16,100,000 tons. This compares with 18,009,250 tons in 1903; 17,821,305 tons in 1902; 15,878,354 tons in 1901, and 13,789,242 tons in 1900, the latter being the largest annual production up to that date.

From the monthly statements of pig iron produced in the United States this year, that for December being estimated somewhat larger than for November, the total will be about 16,100,000 tons. This compares with 18,009,250 tons in 1903; 17,821,305 tons in 1902; 15,878,354 tons in 1901, and 13,789,242 tons in 1900, the latter being the largest annual production up to that date.

A new sawmill and a sulphite plant will be erected at Swanson Bay, B.C. After the manufacture of pulp is well under way, it will be shipped to England. The sawmill will have a capacity of 40,000 feet per day and the sulphite plant will be capable of producing from 35 to 40 tons of sulphite pulp daily. It is the intention of the company—the Canadian Pacific Pulp and Paper Co—

MUNICIPAL BY-LAWS PASSED.

Ottawa, Jan. 2.—(Special)—The by-law for the purchase of the Ottawa Street Railway was overwhelmingly defeated. Only 819 votes were cast in its favor, while the adverse votes numbered 3,557.

Seaforth, Ont., Jan. 2.—A by-law to loan the Canada Furniture Manufacturers $20,000 for twenty years was submitted to the property-holders to-day and was carried by a good majority, only 31 voting against.

St. Mary's, Ont., Jan. 2—The by-law voted on here to-day to guarantee the bonds of the St. Mary's Quarry Company for thirty thousand dollars was defeated by a large majority.

Tilsonburg, Ont—The by-law for concessions to the Wind Motor Co. carried by a large majority.

Elmira, Ont.—Public Library by-law carried by 36 majority.

Caledonia, Ont.—The by-law to bonus a canning factory was defeated.

Thorold, Ont.—Waterworks plebiscite—Majority for waterworks, 50.

Ingersol, Ont.—A bonus by-law to grant a loan to Bradbury & Waterhouse, woollen manufacturers, to make extensive improvements to their plant, was defeated, the required vote not being polled.

Petrolea, Ont.—The by-law to establish a gas plant in this town was defeated to-day by a small majority.

Clinton, Ont.—Hullett township carried the local option by-law to-day by a majority of 18. At the present time there are three licensed hotels in this township—Auburn, Londesboro' and Constance.

Picton, Ont.—A by-law to exempt from taxation for ten years Picton Business College was carried by 52 majority.

Kincardine, Ont.—By-laws for free library and for extension of high school carried by large majorities.

to erect at no distant date, a paper mill in connection with the above plants.

The Dominion Bridge Co., of Montreal, has been awarded the contract to erect a new lift lock at Kirkfield, on the Trent canal. This lock is to lift a distance of fifty feet and is to be one of the most important works of the kind on the continent. This is the second lock of the character to be constructed by the Dominion Bridge Co., the former one being near Peterboro, Ont.

G. D. Campbell & Co., lumbermen of Weymouth, N.S., have purchased the two mills and extensive timber limits of the Sissiboo Pulp Co., at Sissiboo, near Weymouth, N.S. The mills have been idle for the last two years, under foreclosure of mortgage. The property is a valuable one, capable of great development. It is understood the new owners will immediately put the works in operation.

The total production of pig iron in the world last year is figured by the best authorities at 46,733,000 metric tons, a gain of .55 per cent. over the previous year. The output of United States was stationary, Canada and Russia showed decreases. However, the large increase of 20 per cent. by the German blast furnaces materially assisted in bringing the total output of this year above that of last year.

Wilson Foster, of Dawson, who was in Vancouver a few months ago on his way to St. Louis to exhibit the gold mineral specimens of the Yukon, announces the formation of the Alaska-Yukon Gold Co., which will operate under the laws of the District of Columbia. It will have a capital of $5,000,000, and will be hydraulic. A quartz mining plant will also be installed. He is also promoting two other companies.

J. M. McKinnon, managing director of the Canadian Pacific Pulp and Paper Co., who lately returned to Vancouver from England, has announced that the work begun at Swansea Bay, on the mainland, 400 miles above Vancouver, will be continued, and the works will soon be in a position to ship the finest grade of pulp to Great Britain. A sawmill with a capacity of 40,000 feet daily will be erected now; a sulphite pulp plant, of 35 tons daily capacity later. About $300,000 will be spent.

The Robb Engineering Co., Amherst, N.S., has about completed the addition to its machine shop making that structure the second largest machine shop in Canada. This company is now marketing its boilers in the United States as well as Canada. Among the recent contracts are one from San Francisco for a 150 horse-power Robb-Mumford boiler, one from a paper mill in New York State for two large boilers, one from a tannery at Salem, Mass., and another order for a boiler from Springfield, Mass.

Portland cement is about to be manufactured at Tod, B.C., and the plant will be in operation in about a month. The mill will have a capacity of 1,000 barrels a day. The investment will be $350,000. Up to the present all Portland cement has been brought from England, but the demand in British Columbia is very rapidly increasing, and the local market is bound to enlarge. The city of Vancouver alone used about 7,000 barrels last year in cement sidewalks, and in 1905 will take about twice that quantity.

A quarter of a million dollars will likely be expended by the Consolidated Cariboo Hydraulic Mining Co. to get more water for its washing operations. J. B. Hobson, the manager, states that forty square miles are now controlled, and the company has 65 more in prospect. By the expenditure of the amount stated, sufficient watershed will be controlled to secure enough water to last the entire season of seven months, instead of 88 days, as formerly. As the ground has already been proved, the returns will be ample to justify the increased expenditure. Running less than half that time the operations produce enough gold to about defray expenses.

The steel rail industry of the United States is very active at present. The New York Central road has placed an order for 12,000 tons and the Delaware, Lackawanna and Western road has placed an order for 6,000 tons. Some orders calling for 5,000 and 8,000 tons have been received by the Pittsburg plants from bridge constructing firms in Cincinnati, while an order for 14,000 tons for bridge work for the Harriman lines is still pending. Numerous inquiries have been received from Mexico and business of a large order is expected to be transacted very shortly. The United States Steel Corporation have now on their books 425,000 tons of rails for next year's delivery.

Premier McBride, of British Columbia, has announced that at the next session of the B. C. Government a scheme of development of all parts of the province would be begun. For years settlers have, in many parts of the province, sought railway comunication. The country is almost perfect, rich in mineral and agricultural resources, and all that is required is transportation facilities. As soon as a line is projected to the interior, a large number of mines will be opened up, coal measures will be developed, and good times should follow. This is a country where machinery will be used very extensively, and if the Premier's scheme is carried out there will be busy seasons all the time.

The Hamilton Cataract Power, Light and Traction Co. have purchased two motor generator sets from the Canadian Westinghouse Co., Limited. Each consists of a synchronous motor and a direct current generator. The motor generator sets will be of the two bearing type, the generator delivering current at 550 volts to the railway system, and each being rated at 750 k.w. The synchronous motors will take two-phase current of 8,000 alternations and 2,400 volts and will be rated at 1,380 horsepower. The excess of capacity in the motors is provided so that they may be used for raising the power factor of the transmission system. Power is taken through lowering transformers from the high tension transmission lines from the DeCew Falls station of the company.

Canada produced a total of $63,306,690 in economic minerals in 1903, an increase from $22,584,513 in 1896. From 1894 to 1903 Canada's export of lumber and wood products increased from $27,780,352 to $40,868,016. There were in 1901 twenty-five pulp mills as against five in 1881, and the invested capital was $11,555,560, with an output of $4,246,781, giving employment to 3,177 hands. In 1904 the Department of Agriculture published a list showing forty-four pulp and fibre mills in Canada, in addition to six under construction. Their capacity is 1,250 tons a day and the capital invested is about $20,000,000. During 1903 the total output of the pulp mills of Canada was $5,220,000, of which $3,013,441 was exported and $2,206,451 remained for home use. Of the exports, Great Britain took $865,826, the United States $1,899,448 and other countries $248,167.

The holders of the preferred stock of the United States Steel Corporation will this year receive in dividends a a grand total of more than $25,000,000. This sum will be divided among about 43,000 shareholders. As a dividend payer the United States Steel Corporation is exceeded only by the Standard Oil Company, which this year paid $34,920,000 in dividends. Since it was organized in 1901 the Steel Corporation has paid a total of $172,458,000 in dividends to common and preferred stockholders. Since its organization the Standard Oil Company has paid $242,900,000 in dividends to stockholders. There are only 970,000 shares of Standard Oil stock and there is understood to be less than 1,000 stockholders. There are more than 8,000,000 shares of common and preferred stock of the Steel Corporation and close to 100,000 shareholders.

According to a Soo despatch it is officially announced that the Lake Superior Corporation will start the year 1905 with sufficient orders to keep the 500 ton rail mill in continuous operation till the end of September, and with every prospect that within the next month orders will be closed to keep the mill running full till the end of the year.

The Canadian Northern intends to lay 500 additional miles of track, requiring at least 60,000 tons. The Grand Trunk Railway has been put off the rail market for two years trying to make up for losses and will require 30,000 tons for relaying purposes alone. The Canadian Pacific, in addition to the 25,000 tons already contracted for to be delivered before the end of February, will need 40,000 tons in order to carry through their project of relaying the entire system with 80-pound rails as rapidly as possible.

COMPANIES INCORPORATED IN CANADA.

Dorion Lead and Zinc Co., Port Arthur, share capital, $50,000; purpose to carry on in all its branches the business of a mining, milling, reduction, and development company. The directors are: M. Jacoby, H. J. Achenbach, and W. H. Salter, all of Duluth.

Condensed Peat Fuel Co., Peterboro, share capital, $40,000; purpose to carry on the business of a mining, milling, reduction and development company, also to purchase, sell and deal in peat and peat producing lands. The directors are: E. V. Moore, A. L. Davis, D. H. Moore and G. M. Roger, all of Peterboro, and W. A. Salter, of Toronto.

The Alza Co., Montreal, capital $100,000; purpose to manufacture window screens, window sashes and doors with or without their invention, also to do a general business as wood and metal workers. The deirectors are: J. S. Teasdale, H. L. O'Donoghue, and J. C. Moore, all of Montreal.

Adams Bros., Harness Mfg. Co., Toronto, capital $375,000; purpose to take over the business now known as the Adams Bros. and carry on each branch of the business on a much larger scale. The directors are: J. H. Adams, C. Adams, W. H. Adams, and Wm. Stewart, all of Toronto, and F. W. Adams, of Winnipeg.

The United Lumber Co., Montreal, capital $250,000; purpose to manufacture and deal in lumber. The directors are: Geo. A. Forbes, F. Richardson, Geo. H. Bisset, R. T. Heneker and J. J. Robson, all of Montreal.

Campbell Lumber Co., Weymouth, N. S., capital $75,000; purpose to manufacture and deal in sawn timber, lumber, etc. The directors are: G. A. Kohl, W. P. Sharp, R. C. McMichael, F. G. Bush and F. Wilkinson, all of Montreal.

Muskoka Lakes Milling and Supply Co., Toronto, share capital $40,000; purpose to buy timber and manufacture lumber and wooden articles. The directors are: A. E. Henderson, A. Ogden, A. D. Watson, and R. I. Henderson, all of Toronto, and A. A. Young of Rosseau.

The Farmers Manufacturing and Supply Co., Durham, share capital $100,000; purpose to manufacture and deal in goods, wares and merchandise. The directors are: Geo. Binnie, Wm. D. Mills, N. McIntosh and Thos. Livingston, all of Durham, and E. Lackie, of Toronto.

Steel Radiator Co., Toronto, share capital $500,000; purpose to manufacture and sell radiators, heaters, steam fixtures and fittings and other heating apparatus. The directors are: C. E. Safford, of Buffalo; J. G. Smith, N. Sinclair, F. Morrison, and S. Watson, all of Toronto.

Thomson Monument Co., Toronto, share capital $40,000; purpose to manufacture, buy, sell, or otherwise deal in granite, marble, stone and all materials used in the construction of monuments. The directors are: P. Thomson, Wm. Thomson, Jas. Hawken, and R. Macdonald, all of Toronto.

Railway Specialty Co., of Canada, Montreal, capital $20,000; purpose to manufacture and deal in all appliances, articles and commodities used in connection with the operation of railways, tramways, etc. The directors are: J. N. Rattery and Mary I. Hickson, both of Ottawa; E. M. Smith, New York, N. J. Holden, Montreal, and C. F. Quincy, Oconomowoc, Wisconsin.

The Automatic Railway Signal Co., Montreal, capital $500,000; purpose to manufacture and sell and generally deal in a certain "Railway Signalling System" invented by Jos. Lemire, Drummondville, Quebec. The directors are: J. Lemire and Rev. F. Tetreau, both of Drummondville; and M. Langlois, O. Hebert and H. Sawriel, all of Montreal.

The National Construction Co., Montreal, capital $250,000; purpose to take and sublet contracts, also to supply material for the building and operation of railways, telegraph and telephone poles and lines, canals, bridges, elevators, piers, and buildings connected with public works, etc. The directors are: J. Hobson, R. S. Logan, H. W. Walker, F. Scott, and H. Phillips, all of Montreal

The Canada Saw Co., Ottawa, capital $125,000; purpose to manufacture and deal in saws, tools, and sawmill machinery of all descriptions, also to purchase the plants, book debts, stock-in-trade and good will of the Ottawa Saw Company. The directors are: J. M. H. Robertson and F. Bacon, both of Montreal, and G. H. Bindon, P. M. Feeny, J. I. McCracken, C. McGee and W. S. O'Dell, all of Ottawa.

Erie Iron Works, Limited, St. Thomas, share capital $40,000; purpose to buy iron and wood and manufacture industrial products thereof. The directors are: M. Risdon, W. G. Rogers and Wm. Risdon, all of St. Thomas.

Henry Disston & Sons, Toronto, share capital $100,000; purpose to manufacture and sell machinery, saws, files and all kinds of mechanical tools. The directors are: H. Disston, Wm. Disston and H. C. Disston, all of Philadelphia, Pa.

Wahnapitae Power Co., Sudbury, share capital $250,000; purpose to manufacture and generate and supply steam, electricity and natural gas for heating and lighting purposes. The directors are: F. Cochrane and Wm. McVittie, both of Sudbury, and C. A. Maston, of Toronto.

Brooks-Smith Hardware, Limited, Toronto, share capital $75,000; purpose to manufacture and sell hardware, mantels, grates, tiles, implements and machinery. The directors are: E. J. Creeper, J. Brooks, W. M. Smith, W. Brooks, W. H. Carrie, and H. Symons, all of Toronto.

The B and T Roller Bearing Window Co., Toronto, share capital $30,000; purpose to manufacture and deal in roller bearings, window shades, window frames and builders' hardware. The directors are: A. J. Jackson, E. A. Badenach, A. B. Lee, E. J. H. Pauley, and Wm. Bentley, all of Toronto.

Reading Mining Co., Toronto, share capital $250,000; purpose to carry on in all its branches the operations of a mining, milling, reduction and development comnpay. The directors: I. Hollenbach, T. C. Seidle, P. Geisewite, and H. Kramer, all of Reading, Pa., and H. J. Tharle, of Buffalo.

The Standard Brick and Tile Co., Winnipeg, capital stock $40,000; purpose to manufacture brick, tile, pipe, and all other articles manufactured from the products of the earth; also to manufacture artificial stone, plaster, etc. The directors are: G. F. Carruthers, R. W. Gardiner, E. A. Delius, R. J. Gardiner, and H. J. Carruthers, all of Winnipeg.

Toronto Gas and Gasoline Engine Co., Toronto, share capital $300,000; purpose to manufacture and deal in gasoline or gas engines and motors, steam engines, electrical motors, machinery and appliances, launches, boats, vessels, cars, trucks and other conveyances, also to carry on the business of founders and machinists. The directors are: J. and L. C. Laishley, both of Toronto, and R. Hunter, of Toronto Junction.

The Ross, Taylor Co., Exeter, share capital $30,000; purpose to carry on the business of lumber merchants, also to do a general planing mill and saw mill business. The directors are: D. A. Ross, J. Taylor and J. R. Hind, all of Exeter.

Universal Spring Motor Co., Toronto, share capital $250,000: purpose to manufacture electrical motors or any other power-producing device. The directors are: G. H. Campbell, L. F. Ashton and W. B. Bentley, all of Toronto; W. J. Johnson, of Springfield, Ohio; W. G. Morden, of Montreal, and S. Metcalfe, of Galt.

Consumers' Box and Lumber Co., Toronto, share capital $100,000; purpose to manufacture and deal in wooden boxes, lumber, wood-working machines, tools, and builders' and carpenters' supplies; also to manufacture and deal in shingles. The directors are: J. B. Miller, J. McClelland and F. Sully, all of Toronto.

The Canadian Barcalo Mfg. Co., Welland, share capital $40,000; purpose to manufacture and deal in metal beds, bed springs, mattresses, etc. The directors are: E. J. Barcalo, U. L. Candell, A. and W. T. Crombie, of Toronto.

Canada Cycle and Motor Co., New Zealand, Limited, Toronto, share capital $50,000, purpose to acquire as a going concern any part of the business carried on by the Canada Cycle and Motor Co., to deal in motor vehicles, automobiles, bicycles, etc. The directors are: T. A. Russell, E. B. Ryckman, and C. S. MacInnes, all of Toronto.

The Commercial Oil Company, of Hamilton, Hamilton, share capital $100,000; purpose to manufacture and sell all kinds of oils and lubricants used in running machinery, also to manufacture and mix paints. The directors are: J. C. Person, G. L. Person, C. Goring, W. C. Person, and W. J. Morrison, all of Hamilton.

OUR STAFF CONFERENCE AND BANQUET

SATURDAY, December 31, 1904, was an historic day in the annals of The Maclean Publishing Co. The entire day was devoted to a general conference on the work of the company, while in the evening the entire staff, editorial, advertising, business and mechanical, enjoyed the first annual banquet given by the company.

In addition to the Toronto staff, there were present at the conference representatives of the company from Montreal, New York, and Ontario.

In the morning a general conference was held, in which all members of the advertising, editorial and business staffs took part. In the afternoon the work of each paper was considered separately.

While the fact that the firm publishes six trade papers makes for economy of general office expenses, it has been found essential to greatest progress to have each paper cared for by its own editorial and advertising staff.

The afternoon conference was devoted to the particular work on each paper, the result being a better understanding of the work to be undertaken and the adoption of several schemes calculated to enlarge and improve the work of each paper.

In the evening the first annual banquet proved an unqualified success. The chairman of the evening was the president of the company, Col. J. B. Maclean; the vice-chairman, W. L. Edmonds, general manager.

One of the interesting features of the evening was a statement from Mr. Edmonds, giving some facts concerning the development of the company in recent years. Some of the facts referred to were as given below:

The editorial staff has been increased from five to fourteen.

The advertising staff from three to eleven. The circulation department has increased from one to six.

Hardware and Metal, Machinery and The Dry Goods Review are directed from Montreal, while The Grocer, Bookseller and Stationer and the Printer and Publisher are directed from Toronto.

The Montreal, Toronto, Winnipeg, London and New York offices each maintain a manager with an editorial, subscription and advertising staffs.

The editorial, subscription and advertising staff in England has been increased to five, with J. Meredith McKim as manager.

Special permanent correspondents have their headquarters at St. John, Halifax and Vancouver, in Canada; at Birmingham and Manchester, in England; at Paris, France, at Adelaide, Australia, and at Amsterdam, Holland.

Subscription solicitors canvass thoroughly all Canada.

Two advertising solicitors are kept constantly employed in Ontario, covering the territory from Ottawa to Windsor.

Quebec and the Maritime Provinces are visited regularly several times during the year by some members of the Montreal staff.

During the last half of 1904, four distinct canvasses of Illinois, Ohio, New York and Massachusetts were made by representatives from Toronto and Montreal.

Early this month a member of the staff will visit the West Indies in the interests of the editorial and circulation departments.

In addition to the foregoing evidences of expansion, there is to record the launching of a new monthly publication, designated "Machinery and Manufacturing News," the first number of which will appear this month. It will cover more fully a field which has hitherto been a department in Hardware and Metal.

The magnitude of the company's output in the matter of trade newspapers will be perceived when it is stated that there are set up and printed every day of the year an average of 45 pages, size 9 x 12, thus exceeding the output of the largest daily newspaper in Canada.

The Maclean Publishing Co. has the most complete publishing plant of any newspaper concern in the Dominion, the composition, printing, binding and mailing of all its publications being done on its own premises.

Omitting reports of murders, suicides, and other crimes, scandals, local happenings and similar occurrences, The Maclean papers contained more original and exclusive news than any daily in Canada.

Other interesting items of progress and prestige are:

There are twelve university graduates in the service of the company, representing McGill, Queen's, Toronto, and Glasgow Colleges.

Maclean's Trade Newspapers have the largest foreign circulation of any Canadian newspaper of any sort.

The Maclean Publishing Co. use more illustrations in their newspapers than does any daily or weekly publishing concern in Canada.

The Maclean Publishing Co. employs advertising specialists to assist advertisers in the preparation of "copy," whose services to advertisers are entirely free. Of no other newspaper firm in Canada is this true.

The Maclean Publishing Co. are easily the largest consumers of high grade newspaper stock in the Dominion.

In the matter of original cover designs for their several publications, The Maclean Publishing Co. stand alone.

The Maclean Newspapers have never published a line of paid reading matter in their editorial columns; many advertisers and some trade associations have attempted to dictate an editorial policy but none have tried it a second time.

SHIPPING MACHINES TO AUSTRIA.

A representative of Machinery, calling at the works of the Hulburt, Rogers Machine Co., South Sudbury, Mass., the other day, was just in time to witness the shipment of a 600-pound cutting-off machine to Vienna, Austria. Mr. Hulburt informed Machinery that during the last five years the sales of these machines abroad have been very considerable. Samples of work done by these machines in both large and small cuttings were highly creditable.

HOW IT WENT.

THOMAS A. EDISON was one day explaining an intricate machine to a newspaper writer.

"Do you understand?" Mr. Edison would ask. And a moment later, "Now do you understand?"

The poor journalist tried to follow the swift sentences of the inventor, but the effort was vain. Every little while he would have to stop and say that just there he did not quite understand; and then sighing, Mr. Edison would begin all over again.

"I know I am very green as regards machinery," the poor journalist said, apologetically.

"Oh, no, I have seen greener," said Mr. Edison. "Did I ever tell you about the fireman I once met in Canada?"

"Well, in a certain Canadian town where I was running a telegraph office in my youth, a new factory, with a very fine engine house was put up. I visited the factory one day to see the engine. The engineer was out, and the fireman, a new hand showed me about. As we stood admiring the engine together, I said:

"What horse-power has this engine?"

"The fireman gave a loud laugh.

"'Horse-power?' he exclaimed. 'Why, man, don't you know that the machine goes by steam?'"

Recent Development of the Single Phase Motor.

Written for Machinery by G. Percy Cole, B. Sc.*

In the ear' days of alternating current development, and before the advantages of polyphase distribution were thoroughly understood or put into practice, the single phase alternating current generator was the only generating unit employed outside of direct current systems. It held its position for some time both for lighting and synchronous motor operation, but it gradually gave place to the polyphase alternating current generators that have reached the advanced stage as we see them at the present time.

However, there is every prospect that the single phase generator may yet come to the front again, and hold an eminent, if not a pre-eminent place as a generating unit. The reason for this belief is found in the immense strides that have taken place during the last year in the development of the single phase alternating current motor.

These advances have been made not only with stationary power motors, but also with series and repulsion types that are best adapted to railway work so it will be best to take up each type separately.

The Single Phase Alternating Current Series Motor.

This type of motor is the one that is best adapted to electric railroading, as it possesses nearly all the characteristics of the direct current series motor now so extensively used in electric traction work. Its latest and highest development is shown in the motor designed by Mr. Lamme, of the Westinghouse Co., and which is now on the market as a competitor of the direct current series motor.

In the early days of alternating current motor development, although it was well known that the direct current series motor would operate on alternating current circuits if the poles were laminated, most engineers were industriously developing the type with shunt motor characteristic, that is similar to the type to which the Wagner Single Phase Motor belongs. It seemed that only one man, Rudolph Eickemeyer, realized the absolute necessity of the series motor characteristic for railway work. He undertook the development of the single phase alternating current series motor and constructed a number of motors of this type for railway work. On account of the high frequencies then employed in this country (125-133 cycles being then in use) the commutation was not all that could be desired, so for a period of about ten years the advance in single phase series motor development was practically nil. In fact, about the only place we hear of them being used is in connection with starting of single phase synchronous motors. For this purpose, small series wound motors with laminated fields were used, but were said to develop very little power on account of their enormous self-inductance.

In 1888 it was pointed out by Kapp that the power factor of the alternating current series motor was inherently low, since the same magnetic flux which induces the E.M.F. of useful work in the armature, proportional to the frequency of rotation, also induces in the field coils an E.M.F. of self induction, proportional to the frequency of alternation. Even at synchronous speed, the E.M.F. of rotation of the armature would still only be equal to the E.M.F. of self-induction of the field and power factor, allowing for an additional self-induction of the armature, would be below 70 per cent.

G. P. Cole, B.Sc.

The power factor of the Eickemeyer motor was nearly 90 per cent., due to his designing the armature with a number of turns several times greater than the field, and neutralizing the armature self-induction and reaction by a stationary secondary circuit surrounding the armature at right angles electrically to the field circuit, and either short-circuited upon itself or energized by the main current in opposite direction to the current in the armature. The commutation of this motor was said to be perfect at 33 cycles and fair at 85, but 133 cycles, the frequency then in use, must have discouraged development in this line at the time as 60 cycles was then hardly considered and 25 cycles not yet proposed.

The introduction of the lower frequencies, however, seemed to give a new impetus to the alternating current series motor, so at the close of 1903 we had the simultaneous announcement that from three different countries a practical single phase motor had been developed in each of them; in this country by Mr. Lamme and across the water by Dr. Finzi and Eichberg & Winter.

Mr. Lamme's motor shows great skill in design and shows an entire absence of sensational features. The motor is a simple series-wound structure with a very powerful armature, high resistance commutator leads, and pole faces perforated longitudinally to break up cross-induction. To obtain good commutation, the frequency is kept low (about 25 cycles being used) the voltage is kept moderate (250 volts) and the poles are fairly numerous to bring the rotative speed to the best working point as regards the armature alternations. One of the great advantages of the series motor is that it can also be operated on direct current circuits, thus making it available, say for instance, passing through a town with an existing direct current system. The two motors which are usually wound for 250 volts, could be thrown in series and operated on the 500 volt direct current line.

The Finzi single phase motor is also used for traction purposes. It is a series motor, and the same practices are resorted to, to secure good commutation, as in the case of the Lamme motor. Its characteristics are laminated multipolar field core with longitudinally divided poles, a small air gap, low speed and a set of resistances connecting the inductor windings to the commutator sections. The power factor of this motor is very high and the motor is said to possess a fairly high efficiency over wide ranges of speed, and the commutation is very satisfactory, even in starting. In fact, it is claimed that this motor behaves better in respect to sparking than the corresponding continuous current traction motor.

Single Phase Repulsion Motor.

Another type of single phase motor that has made great strides during the

* Mr Cole is head of the motor designing department on the engineering staff of the Wagner Electric Manufacturing Co., St. Louis, and has made a special study of alternating current motors.

past year is the repulsion motor. This motor has characteristics similar to the direct current series motor and will thus find a place in the alternating current railway field. The operation of the repulsion motor is worthy of attention since all the Wagner single phase motors start as repulsion motors and run as such until the short-circuiting device operates and the brushes are released. In fact, if the governor weights and short-circuiting device are removed and allowed to run on the brushes, the Wagner motor will operate quite well as a repulsion motor, and with very little sparking if the frequency is lowered to about 40 cycles. When operating as a repulsion motor, it can be reversed by simply shifting the brush past the reversal point.

For a little over a year now, the engineers of the General Electric Company have been developing this type of single phase motor, and so successful have been their efforts, that they are now prepared to equip any electric railway system with repulsion motors.

In many ways the repulsion motor is much ahead of the single phase series motor, two of its main advantages being (1). It has a better power factor. (2). With the repulsion motor it is not the line voltage that is being commutated, but the induced armature current.

As this motor promises great things in the railway field of the future, a short description of some of the machines the General Electric Company have constructed for their tests, may not be out of place here. Three different machines have been made. The first one was a 50 h.p. 6 pole machine. This was experimented with in many ways, among other things tried was tapping the motor in three places and putting across reactance coils in place of resistance. This, they claim, gave a constant speed motor. The speed was kept at synchronism since the reactance coils were in multiple with the motor winding and the impedance least at synchronous speed.

Their second machine was a 4 pole 50 h.p. equipped with three different stators and three different rotors so as to try the different windings. The commutator is like a direct current commutator and ordinary brush holders with a stud for each pole is used.

The third machine is a 400 h.p. 8 pole and has eight sets of brushes with 5 on a stud. The brushes used are 1¼ in. by 1¼ in., but even with brushes this size, there is a very high brush density as about 2,200 amperes have to be commutated.

They are now at work with a machine of which they expect great things. It has an air gap of ⅛ of an inch, which you will observe is very large. The General Electric engineers seem to have no misgivings as to the ultimate success of this type of single phase motor, for it is clearly shown by the way in which they are pushing investigations in the field.

The Schuler-Ferranti Single Phase Motor

This motor belongs to the same class as the Wagner motor and which may be termed "Repulsion Induction Motors," in that they start as repulsion motors and after a certain speed has been attained, all the segments of the commutator are short-circuited and they continue to run as induction motors. One of the characteristic features of the repulsion motor is its good starting performance, but as a rule, its running performance is not always so good. This is the reason why we short-circuit the commutator in the Wagner motor, so as to obtain the advantages which accrue from running as an induction motor. In the Wagner motor, the short-circuiting of the commutator is accomplished by the governor weights and short-circuiting segments. In the Schuler motor, this change from induction to repulsion motor, if done slowly is almost imperceptible, as it is effected with the help of slip rings and a star-connected rotor resistance, through which the rotor windings are gradually short-circuited. The brushes remain short-circuited and more or less current passes through them in accordance with the manipulation of the resistance. At synchronous speed, practically no current passes through them as the rotor windings are completely short-circuited at the slip rings and the motor is then operating as an induction motor. At speeds intermediate between standstill and synchronous speed, part of the rotor current passes through the short-circuited commutator brushes and part through the rotor resistance; under these conditions it is working partly as a repulsion motor and partly as an induction motor.

The Schuler motor is thus a motor that allows of starting with a large torque without drawing an excessive starting current and of a speed regulation over a wide range with smaller losses in the rotor resistances than would be the case with the corresponding 3 phase motor operating under similar conditions.

Latour and Winter Eichberg.

There is still another type of single phase motor that has shown marked advancement lately across the water, but about which, unfortunately, we know very little on this side. It is the so-called series repulsion motor of Latour and of Winter-Eichberg. The most promising developments of the single phase motor in the near future, will probably be along the lines of these motors. These motors are partly repulsion motors and partly series motors. They differ in two important respects from all other series or repulsion motors—the power factor is nearly unity under all conditions of working, while the field flux is produced by the rotor instead of the stator. By supplying the commutators at constant pressure (if necessary through a step-down transformer of suitable size) instead of variable pressure, these motors behave as direct current shunt motors and would, therefore, be applicable to ordinary industrial work.

As to constructional features, the stators of these motors are just like the stators of ordinary induction motors. Latour, however, prefers to distribute the winding all round the periphery to form a closed circuit, there being thus (in a 2 pole motor) two parallel paths traversed by the single phase current. The rotors are simply specially proportioned direct current armatures with amply dimensioned commutators of many segments. The properties of these motors as indicated by the very little data we have at present, are very promising. They permit of easy and efficient regulation of speed over a wide range, they give ample torque for rapid acceleration, and they have power factors sufficiently high to obviate fear of difficulties on that score. At or near full load and speed, the power factors are considerably higher than those of the best induction motors and only in starting from rest do the power factors fall to a considerably low figure.

As I said before, we know very little about these motors just now, but hope to know more about them in the near future.

TRUE COURAGE

"The greater part of the courage that is needed in the world is not of an heroic kind. Courage may be displayed in every-day life as well as on historic fields of action The common need is for courage to be honest, courage to resist temptation, courage to speak the truth, courage to be what we really are and not pretend to be what we really are not, courage to live honestly within our means and not dishonestly upon the means of others."

Practical Questions and Answers

From Science and Industry

Size of Gasoline Engine.

Q. What horse power gasoline engine will it require to run a dynamo having a capacity of 100 16-candle power lights? Actual brake horse power is meant, not nominal or indicated.

Ans. The engine would have to deliver about 10 brake horse power. The actual amount of power required to run the lamps would be about 8 horse power, but in order to allow for losses in the lines and dynamo and also in belt friction, it would not be advisable to install an engine smaller than 10 horse power.

An Engineer's Inquiries.

Q. Please explain by example how large a hole can be safely cut in a steam boiler without having to put on a ring. Please give constant for steel and iron. (b) Can the guides on an engine be used for leveling the engine on the foundation?

Ans. It is impossible to give any formula or constant for such a thing as this. It depends largely on the thickness of the plates and the pressure inside of the boiler. As a general thing it is better to reinforce, with rings, all the holes more than two inches in diameter. Experience and good judgment are the best guides in a matter of this kind. (b) Yes.

Lamp Candle Power.

Q. (a) How can the candle power of a lamp be calculated? (b) Would the candle power of an acetylene gas burner be increased by using a reflector?

Ans. (a) The candle power of a lamp is measured on a photometer, not calculated. A standard gas flame is arranged at one end of a bar, and the lamp to be measured at the other end. A carriage bearing a screen and mirrors, for comparing the intensities of the light, is mounted on the bar and is movable. The screen and mirrors are moved to such a point that both sides of the screen are equally illuminated. The candle power of the lamp being tested is found by multiplying the candle power of the standard gas flame by the quotient obtained by dividing the square of the distance of the lamp from the screen, by the square of the distance of the standard from the screen. (b) The mean horizontal candle power of the lamp itself would be the same, but there would be a much stronger light in one direction as the light rays are concentrated by the reflector.

Pump Trouble.

Q. I have a compound duplex Worthington pump, size 14 x 20 x 12 x 10, which has run without a jar or pound for a number of years until about one week ago, when a pound developed in the water end. Can you suggest a remedy or tell me where I can find the trouble?

Ans. Pounding in a pump is usually due to one of the three following causes: striking of the piston against cylinder head, broken or deranged water valves, or water hammer in the pipe connections. Without a personal examination of the pump it is impossible to state which of these three causes is making you trouble. Since, however, the pump has worked quietly for a long time, it is safe to say the water hammer is not the cause. We suggest that you examine the pump for broken valves in the water end, and if everything is all right re-set the steam valves.

Most Economical Engine.

Q. Which would give better service, two engines of 5 and 7 horse power respectively, coupled to one shaft, or one engine of 12 horse power? (b) Would the 7 horse power engine use some of its power to run the smaller?

Ans. The 12 horse power engine would be the more economical. The mechanical efficiency of ratio of the delivered horse power to the indicated horse power decreases very rapidly as the size of the engine decreases. The loss from friction, cylinder condensation, etc., in a 5 horse power and a 7 horse power engine would considerably exceed the corresponding loss in a 12 horse power engine. (b) No. Each engine would deliver to the shaft its excess over the power required to overcome its own frictional resistances, and since each engine is transmitting power to the shaft, there could be no transmittal of power from the shaft to either engine.

Which Most Economical?

Q. Which is the more economical in the use of steam, a simple or a compound engine, when rated at one-fourth the rated capacity? (b) Why?

Ans. Generally speaking, the compound engine is more economical. (b) The reason for this is the reduction in the amount of cylinder condensation through the use of two cylinders. It is well to bear in mind that compounding practically doubles the friction of an engine, and if the power to be delivered is small the gain by the use of two cylinders may be more than counterbalanced by the increased friction. It will be seen from this that the size of the engine enters into the problem. An engine of small power would be uneconomical as a compound, because the friction would constitute such a large per cent. of the total power, and an engine of large power would be uneconomical as a simple engine, because of the excessive cylinder condensation. It is also seen that a point at which an engine would be economical as a compound if worked to its full capacity, and yet uneconomical when worked at only one-fourth its full power.

Calculating Pitch of Teeth.

Q. Please give me a method of calculating the required pitch of the teeth of a gear, when the greatest strain on the teeth is known, and the width of the face is fixed. For instance, I have a load of 16,000 pounds coming on the teeth of a gear 20 inches in diameter and 4-inch face, the gear being of cast-iron. This load is the greatest that can come on a gear, and comes while the gear is at rest.

Ans. The conditions which you have are such that it is impossible to obtain any practical solution to the problem. Take the formula,

$$C = \frac{16\ 8\ p.}{Sb.}$$

in which C=circular pitch; p=load on the tooth in pounds; S=4,200 for cast iron; and b=4 in. = face of the gear. According to this

$$C = \frac{16\ 8 \times 16{,}000}{4{,}200 \times 4} = 16 \text{ in.}$$

The thickness of the tooth at the pitch line being equal to about half the circular pitch, it would have to be 8 inches thick. Such a tooth thickness for a gear 20 inches in diameter is, of course, utterly absurd. It will be impossible for you to obtain a gear of the stated diameter and face, to withstand the given load. It will be necessary for you to change some of the conditions. For slowly-moving cast gears the face should be from 2 to 3 times the circular pitch, and we see no better way than for you to alter the dimensions of your gear.

Brass Scraper.

Q. What kind of tools are used for scraping a worn brass box of a gas engine?

Ans. A tool called a scraper is used for this purpose. It is generally made by taking an old file and grinding the teeth off it, leaving the edges sharp. The course in Shop Practice taught by the International Correspondence Schools, Scranton, Pa., contains information on subjects of this kind.

Fly-Wheel Utility.

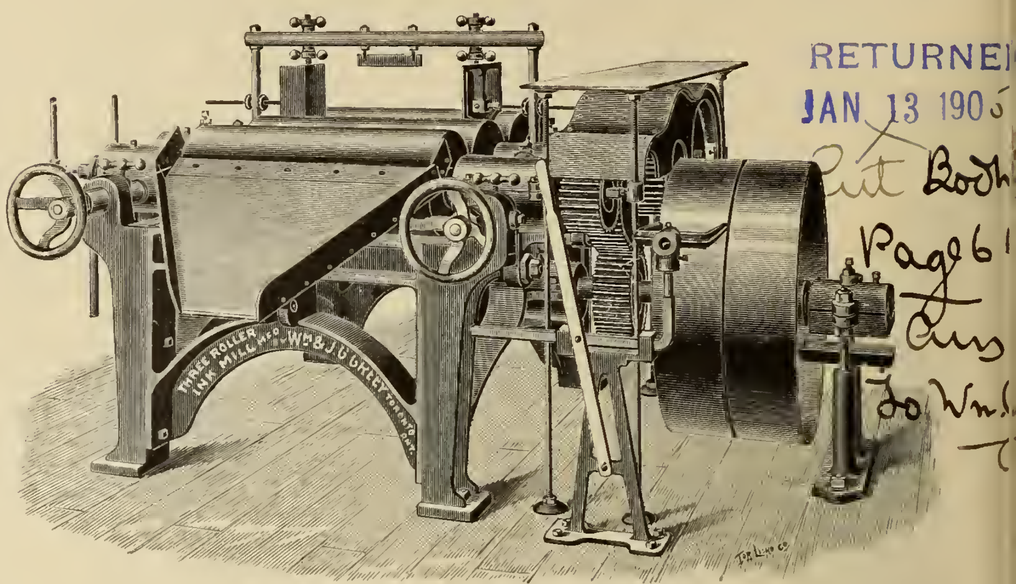
Q. I have charge of a double hoisting engine having cylinders 9 x 14 inches. If a flywheel is placed on one engine will it do the same work that was formerly

done by both engines without the fly wheel?

Ans. No, the purpose of a flywheel is to promote uniformity of turning effort on the part of the engine, and it in no way serves to increase the power of the engine. The power of any engine is equal to the product of the mean effective pressure, the length of stroke, the area of piston, and the number of strokes per minute. Hence the only way to increase the power of an engine is to increase either the M.E.P. or the number of strokes per minute.

IMPROVED THREE ROLLER INK OR COLOR MILL.

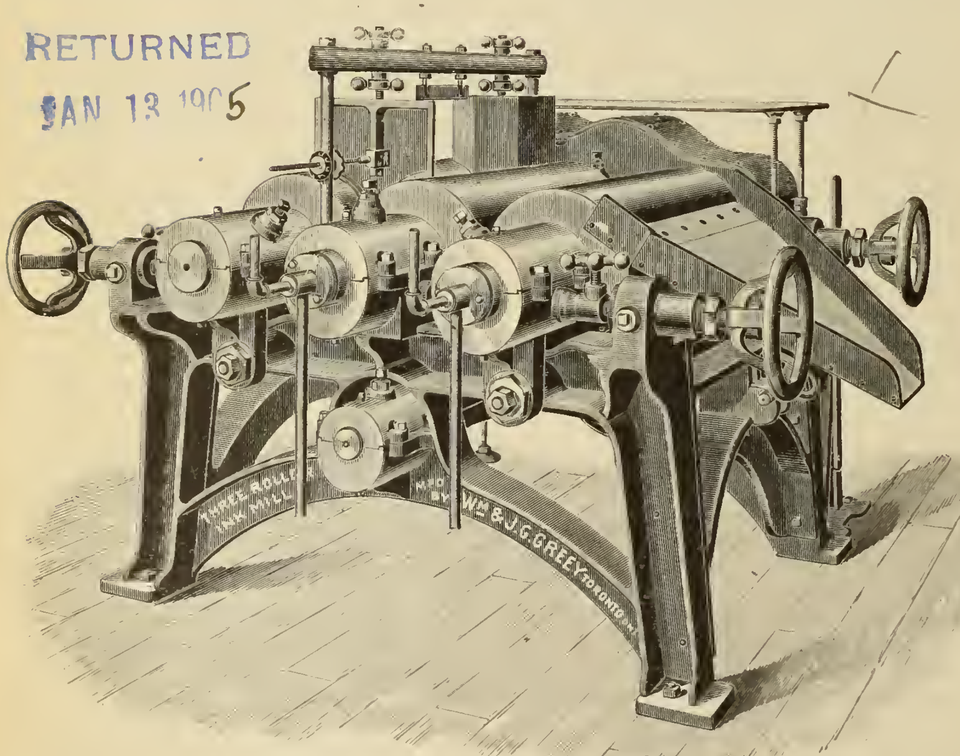
IMPROVEMENTS have been made in the design of color mills for grinding printing or lithographing ink-colors in oil or japan, chocolate, soap, blacking, white lead and any pasty material. The demand for machinery of this class in Canada is as yet limited, but is steadily increasing and in order to keep abreast of the times Wm. & J. G. Greey, Toronto, have developed a machine which approaches a high degree of excellence. The improvements on this machine are, firstly, that the rolls may be trammed for the purpose of keeping them in true alignment, and also the ease in which this is accomplished: secondly, all bearings are of finest quality bronze metal, are ball and socket, adjustable-ring oiling and it is impossible for bearings to bind at any point, get out of tram, or become heated; thirdly, in solidity of frame and freedom from vibration, durability, strength and rigidity under any strain when grinding heavy pigments.



Greey Ink or Color Mill—End View.

Cut Both
Page 61
Ans
To Wm.

The rolls furnished are of hardest chilled iron, the result of many years experience in roll making, ground absolutely true and have a highly finished surface, the rolls will wear for years grinding the hardest colors without grinding out of true and doing better work than granite without danger of chipping and breaking. Hollow rolls steam heated or water cooled and granite rolls are furnished if desired. Shafts are of steel, extra long, of large diameter and accurately finished. The roll has adjusting wheels for front and back rolls within easy reach of operator so that setting or adjustment of rolls is under perfect control. Gearing is of powerful cut, and absolutely noiseless gears and amply guarded for the protection of the operator as shown in illustration.



Greey Ink or Color Mill—Side View.

The material is fed into the rolls between two adjustable bronze color conductors placed over the two back rolls which can be set to feed any desired quantity, on being ground the material is detached from the last roll by a scraper whose tension against the roll is regulated by means of a wheel and screw, the wheel pressing a steel spring can be regulated to any desired pressure, and also allows the scraper to adjust itself when the position of the roll is changed, by turning hand wheel to right scraper is unlocked and can be thrown back and cleaned; the apron is an improved detachable planed metal spout.

The accompanying cuts show the roll completed and ready to run. The smallest size made is 6 inches by 14 inches rolls, the largest 16 inches by 30 inches. Chilled iron rolls are superior to any other method for grinding these materials both as to capacity and finish. In addition to the above machinery Wm. & J. G. Greey make complete installations for flour, paint and spice mills, also machinery and supplies for soap and cement works, tanneries, etc., as well as full lines of power transmission and elevating apparatus.

Construction and Improvement

Factory Construction — Contractors' Supplies

MODERN FIREPROOF METHODS. FACTORY CONSTRUCTION.

FACTORY construction is undergoing the same radical change now familiarized to us in the modern office building. This is for no other reason that that the methods adopted by architects and structural engineers in their war against the "red plague" have proven in the latter case so effective. It is now conceded that the factory which can be cheapest and most quickly built does not make for economy. The fire risk is too great to permit of economical wood construction, and on the other hand the improved wood construction, such as the underwriters now call for, is too close in cost to systems confessedly fireproof.

Concrete easily occupies the premier position as a fire-resisting material, therefore, starting with a steel frame scientifically protected therewith, and reinforced concrete floors and roof, the factory designer has been able to attain his end satisfactorily. The walls may be either of brick, concrete or—for many classes of manufacturing—of cementine, the last being a combination of Portland cement mortar and expanded metal lath on steel studs. Metal frames for doors and windows are a desirable addition.

The new buildings of the Dominion Coal Co. at Glace Bay, and the rail mills of the Dominion Iron and Steel Co. at Sydney in Cape Breton; the wheel-house of the Capital Power Co., the E. B. Eddy Co. mill, the Bronson Carbide power house, all at Ottawa, are examples of this construction.

Expanded metal floors are standard everywhere throughout the civilized world. There is no other scheme of floor building which permits the almost indescriminate cutting of holes—this being an important feature in factories, where changes in the location of machinery are apt to be frequent. Another point scored by expanded metal and concrete is its obvious adaptability as a resistant to vibration, being a monolith of steel and concrete.

It is very easy, at reasonable cost, to to build a factory in wood frame that will possess admirable fireproof qualities. The floor loads and roof load are carried by wood posts and horizontal wood girts are built between them, the girts being about nine or ten feet apart in the following manner:

The panel wall between is constructed of small steel studs (3-4 inch channel section) are nailed or stapled to the girts, being spaced at 12 inch centres. To these the expanded metal lathe is wired and Portland cement mortar is plastered on to a total thickness of two inches. The studs and lath are completely covered on each side. The strength of this cementine wall is wonderful and the weight is only 18 lbs. per square foot. If required, the posts, girts and other framing timbers may be covered with expanded metal lath and similarly fireproofed with Portland cement mortar. The roof method of construction is identical with that of the walls.

There are many particular uses for which cementine work is being largely used. The enclosing of stair and elevator openings, ventilation flues, or ducts of any nature are some of these; also fire curtains for the protection of trusses, like those installed at the International Harvester Co.'s large plant in Hamilton, Ont.

Dominion Coal Co. Buildings, Glace Bay, C.B.
Dominion No. 2 Pit. Both walls and roofs of these buildings are of Cementine construction.

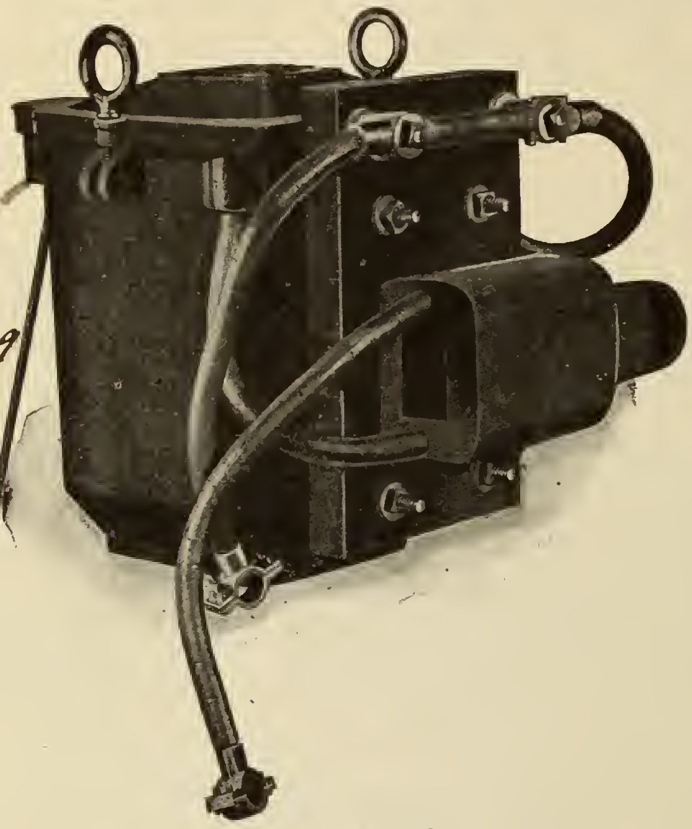
THE SMALLEST MOTOR IN THE WORLD.

THE smallest electric motor in the world is described by the Street Railway Review, as being built by a watchmaker whose work has trained him to handle delicate machinery. It was made with all the exquisite care required in making a motor that moves with all the regularity of a big machine, and yet is so small that its owner wears it as a scarf pin. Viewed from a little distance the article has the appearance

of a very valuable and rather curiously designed pin. It is only when standing near to it that its nature can be discovered. The first thing to attract attention is the buzzing of the machine, which by means of current obtained from a small battery carried in the vest pocket, is kept in operation at a high rate of speed with a noise like a bee buzzing.

THAWING WATER PIPES.

A TRANSFORMER for the purpose of producing a large current has recently been placed on the market by the Pittsburg Transformer Co., an illustration of which is shown. It is used in connection with a choke coil



Pipe Thawing Outfit.

and heat indicator for thawing frozen water pipes.

The outfit consists of a transformer adapted to operate on any circuit of approximately 1,100 or 2,200 volts and 60 or 133 cycles. The transformer will deliver a current of 300 amperes continuously, or currents of about 600 amperes for periods of half an hour.

On the back of the transformer are mounted a heat indicator and a choke coil. The heat indicator consists of a section of lead pipe, connected in series with the transformer, and the temperature which this assumes is a guide as to the heating of the pipe under treatment. The choke coil consists of a few turns of heavy copper bar, with a movable laminated iron core. When this plunger is pushed entirely into the coil, the transformer secondary may be short-circuited, but no more than normal current will flow.

NOTES ON THE EFFICIENCY OF GAS TURBINES.

THIS is a theoretical study by M. Alfred Barbazet of the conditions of operation of the Armengaud-Lemale gas turbine. This turbine consists of an impulse wheel resembling the De Laval wheel. On one side is placed the combustion chamber, which consists of a bell-shaped retort lined with refactory material, terminating in an expansion nozzle. The gas and air are forced in at the end opposite to the nozzle, and are ignited by an electric arc, combustion taking place in the chamber. The products of combustion passing out through the nozzle require a certain velocity and impinge upon the blades of the turbine. The nozzle itself is water-jacketed. The speed at which the wheel revolves is such that the gas has a certain velocity when it leaves the blades. The hot gases are then passed through a steam generator, made in the form of a coiled pipe, the diameter increasing successively until it terminates in a second expansion nozzle. The steam generated in this boiler is thus directed against the turbine blades, adding to the propelling force, and at the same time cooling the blades. Complete combustion is attained in twenty per cent. excess of air. A machine of this type has been operating for two years at St. Denis, Switzerland, and sufficient have been collected to enable the process to be considered satisfactory. The thermo-dynamic efficiency approaches that of the Diesel motor, being 53.5 per cent. The total efficiency is given as eighteen per cent. The latter figure will be considerably improved with better construction, it being thought that the mechanical efficiency of the turbine will be raised to sixty per cent., and that of the air-compressor to eighty per cent. This will give a total efficiency of the machine of twenty-six per cent. With this figure, one horse power will be given with a consumption of 220 grammes of oil.—Electrical Review.

SIX-SPINDLE DRILL.

(See page 23 for cut.)

ONE of the drilling machines built by H. G. Barr, Worcester, Mass., is illustrated. It is a 6-spindle 14 in. to 16 in. swing, with lever feed, 5 in. pulleys, No. 1 Morse taper. These machines are built in five styles of single spindle, all having lever feed and 5 in. pulleys on spindles. There are 2, 3, 4, 5, 6, 7-spindle machines having 14 in. to 16 in. swing lever feed, and 18 in. to 20 in. swing having the same pulleys. All the above have No. 1 Morse taper in the spindles. Power feed driven and used independent to each spindle can be furnished if desired on all multiple spindle drilling machines.

There is a line of drills from 2 to 6-spindles having 7 in. pulleys on the spindles with No. 2 Morse taper in the spindles. These are provided with power feed, automatic stop, quick return, swing 18 in. to 20 in., and can be furnished without the power feed and used as a lever feed drill if desired.

There is also a line of 2, 3, 4, 5, 6-spindle machines with geared spindles having 7 in. pulleys, which give great power for so light a machine. All of the smaller machines have a spindle travel of 3½ in., all the larger ones have a travel of 5 in., all have adjustable heads and adjustable tables. All tables on multiple drills are raised with a crank through bevel gears and screw running in a brass not in the table.

The columns are heavily braced inside and are very rigid. The tables are very large and heavy, the lighter machines having oil groove around tables while the larger ones have plain tables 16 in. wide. Special tables are made to order when wanted.

There are several of these machines in the vicinity of Montreal and Toronto, ranging from one to six-spindles to a machine, but as yet none with power feed, or of the heavier type. Agents, both in Montreal and Toronto, represent these tools.

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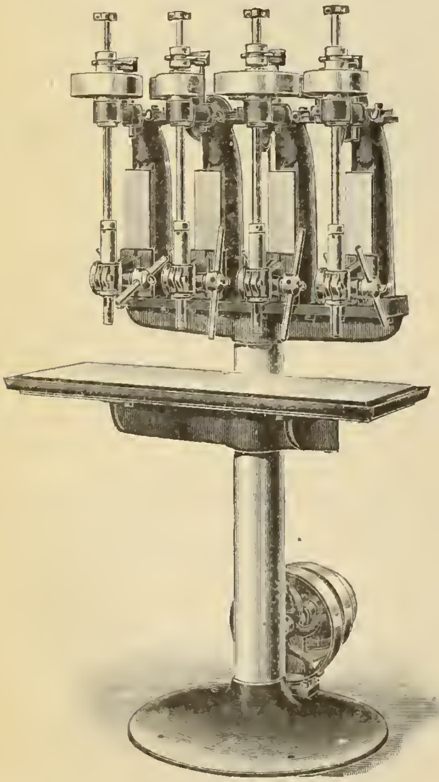

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72 in. x 14 ft. Horizontal Return Tubular Boiler, in fine order.
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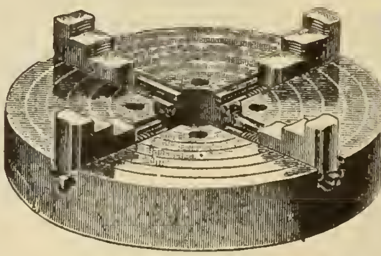

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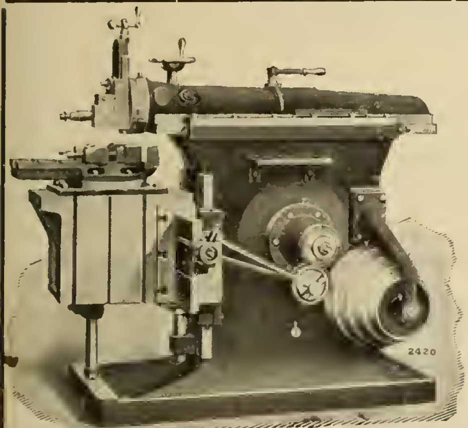

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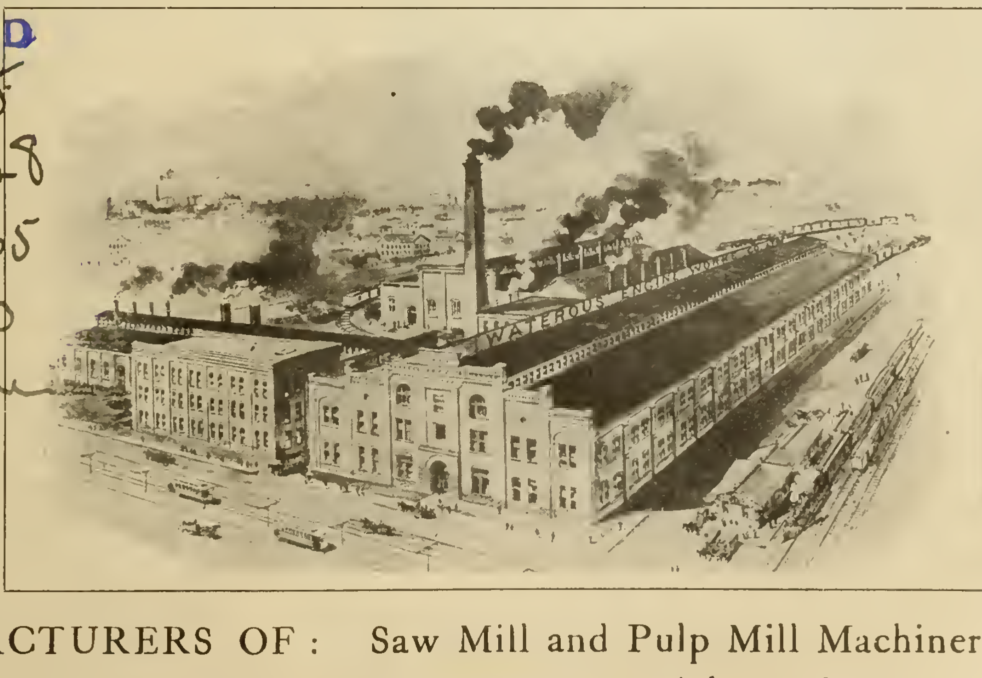

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H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Drilling Machines, Multiple Spindle.
American Tool Works Co., Cincinnati.
Bickford Drill & Tool Co., Cincinnati

Drilling Machines, Pneumatic
Allis-Chalmers-Bullock Co., Montreal.

Drilling Machines, Radial.
American Tool Works Co., Cincinnati.
Bickford Tool & Drill Co., Cincinnati
The Fairbanks Co., Montreal
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Drilling Machines, Upright.
American Tool Works Co., Cincinnati.
The Fairbanks Co., Montreal.

Drop Forging.
The Globe Machine and Stamping Co., Cleveland, Ohio.

Drop Forging Dies.
The Globe Machine and Stamping Co., Cleveland, Ohio.

Dynamos.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Packard Electric Co., St. Catharines.
United Electric Co., Toronto.

Electrical Supplies.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The United Electric Co., Toronto.
Packard Electric Co., St. Catharines.

Electrically Driven Tools and Machinery.
American Tool Works Co., Cincinnati.

Electrical Repairs.
Volta Electric Repair Works, Toronto.

Emery Wheel Dressers.
The Globe Machine and Stamping Co., Cleveland, Ohio.

Engines.
Levy, Weston & McLean Machine Co., Toronto.

Engineers' Supplies.
Levy, Weston & McLean Machine Co., Toronto.

Engines, Gas and Gasoline.
The Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Engines, Steam.
The Goldie & McCulloch Co., Galt, Ont.

Expanded Metal.
Expanded Metal and Fireproofing Co., Toronto.

Feed Mills.
S. Vessot & Co., Toronto.

Files.
G. & H. Barnett Co., Philadelphia.

Forges.
Sheldon & Sheldon, Galt

Gear Cutting Machinery.
Bickford Drill & Tool Co., Cincinnati.

Generators.
The United Electric Co., Toronto.

Grinders, Cutter.
Cincinnati Milling Mach. Co., Cincinnati.

Grinders' Tool.
Armstrong Bros. Tool Co., Chicago.

Grinding and Polishing Machines.
The Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Hammers, Pneumatic.
Allis-Chalmers-Bullock Co., Montreal.

Iron Tools.
Levy, Weston & McLean Machine Co., Toronto

Lathes.
American Tool Work Co., Cincinnati.
The Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Lumber Dry Kilns.
Sheldon & Sheldon, Galt.

Machinery Dealers.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machine Co., Toronto.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.
C. C. Wormer Mach. Co., Windsor

Mechanical Draft.
Sheldon & Sheldon, Galt.

Milling Machines, Plain.
American Tool Works Co., Cincinnati.
Cincinnati Milling Machine Co., Cincinnati
The Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Milling Machines, Universal.

American Tool Works Co., Cincinnati.
Cincinnati Milling MachineCo.,Cincinnati
The Fairbanks Co., Montreal.
H W. Petrie, Toronto.
A R Williams Co. Toronto.

Motors.

The United Electric Co., Toronto

Motors, Electric.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Oatmeal Mill Machinery.

The Goldie & McCulloch Co., Ga't

Planers.

American Tool Works, Cincinnati.
Cincinnati Planer Co. Cincinnati.
The Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Pulleys.

The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt.

Pumps.

The Goldie & McCulloch Co., Galt.

Punches and Dies.

The Globe Machine and Stamping Co., Cleveland, Ohio.

Saw Mill Machinery.

Levy, Weston & McLean Machine Co., Toronto.

Second-hand Machinery.

Levy, Weston & McLean Machine Co., Toronto.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.
C. C. Wormer Mach. Co., Windsor

Sheet Metal Goods.

The Globe Machine and Stamping Co., Cleveland, Ohio.

Speen Changing Countershafts.

The Dodge Mfg. Co., Toronto.

Shapers.

American Tool Works Co., Cincinna
Cincinnati Shaper Co., Cincinnati.
The Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
A. R. Williams Co., Toront

Special Machinery.

The Globe Machine and Stamping Co., Cleveland, Ohio.

Special Manufacturing.

The Globe Machine and Stamping Co., Cleveland, Ohio.

Stampings Sheet Metal.

Globe Machine and Stamping Co., Cleveland, Ohio.

Switch Boards.

The United Electric Co., Toronto.

Tapping Machines and Attachments.

American Tool Works Co., Cincinnati
Bickford Drill & Tool Co., Cincinnati

Tool Holders.

Armstrong Bros. Tool Co., Chicago

Transmission Machinery.

The Dodge Mfg., Toronto.

Transmission Supplies.

The Goldie & McCulloch Co., Galt.

Turret Machines.

American Tool Works Co., Cincinnati
The Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Vaults.

The Goldie & McCulloch Co., Galt.

Vises, Planer and Shaper.

Cincinnati Planer Co., Cincinnati.

Window Wire Guards.

The B. Greening Wire Co., Hamilton

Wood-working Machinery.

Levy, Weston & McLean Machine Co., Toronto.

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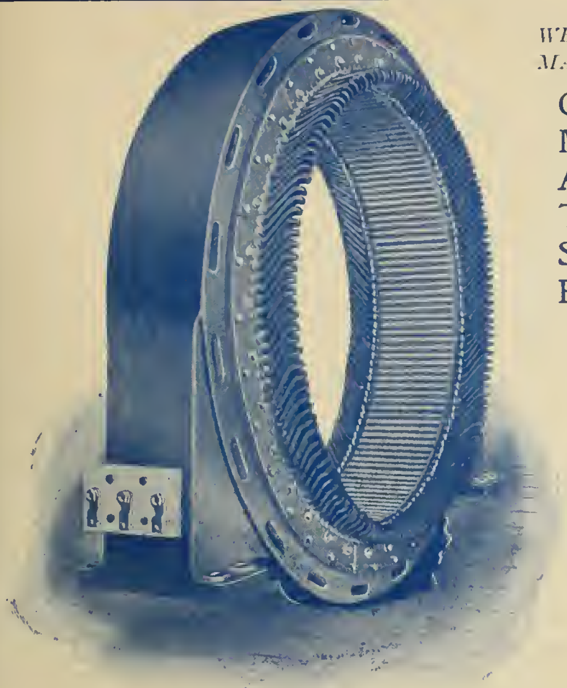

WE MANUFACTURE

Generators
Motors
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Transformers
Switch Boards
Etc.

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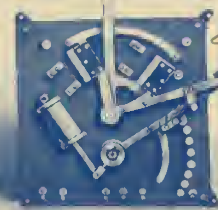
Our New Patented Multiple-speed Motors for driving all classes of machine tools, printing presses, hoists, etc., can not be equalled for economy and durability. No controllers or resistance boxes required.



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The Owen Sound Iron Works Company, Limited

Engineers, Founders, Machinists and Boilermakers

of OWEN SOUND, ONTARIO.

Manufacturers of Saw, Shingle and Lath Machinery.

Engines and Boilers and Tank Work.

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SPECIAL ATTENTION IS PAID TO MARINE REPAIRS OF ALL KINDS TO ENGINES, BOILERS OR STEEL VESSELS

CANADIAN

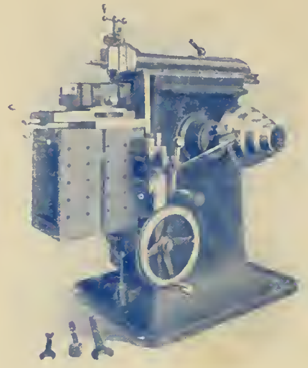
MACHINERY

and Manufacturing News.

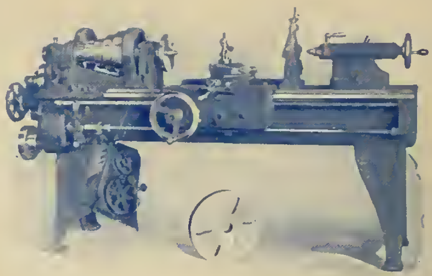
A MONTHLY PAPER DEVOTED TO THE MACHINERY AND ELECTRICAL TRADES, AND TO ALL USERS OF POWER

VOL. XVII. (Old Series) MONTREAL AND TORONTO, FEBRUARY, 1905. (New Series) VOL. I. No. 2.

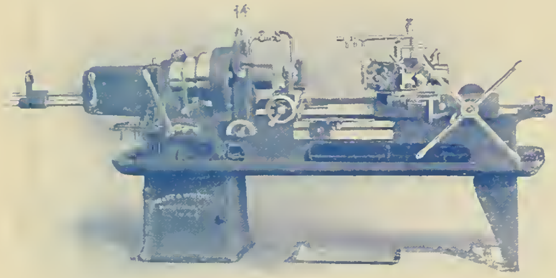
6 x 80 inch Thread Milling Machine



14 inch Shaper

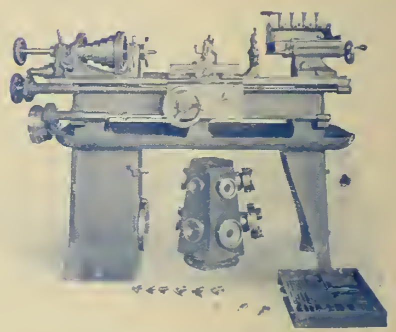


14 inch Lathe



2 x 26 inch Turret Lathe

Profiling Machine

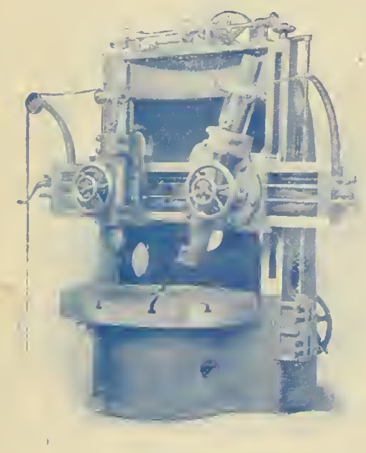


10 inch Toolmakers' Lathe

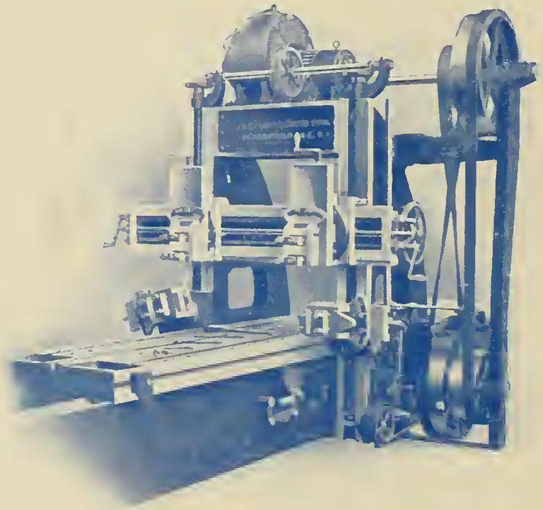
PRATT & WHITNEY CO. 136 Liberty St., New York

THE FAIRBANKS CO., Agents for Canada

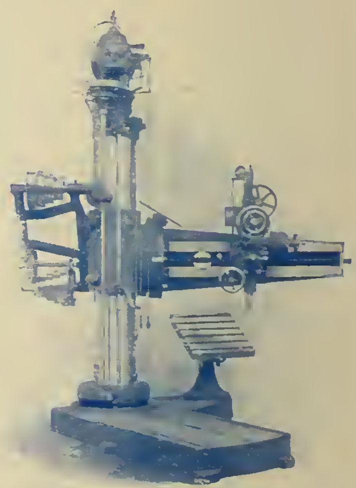
MONTREAL, TORONTO, WINNIPEG and VANCOUVER.



51 inch Niles Boring Mill



42 inch Pond Forge Planer



$5\frac{1}{2}$ ft. Niles Radial Drill

NILES-BEMENT-POND CO.

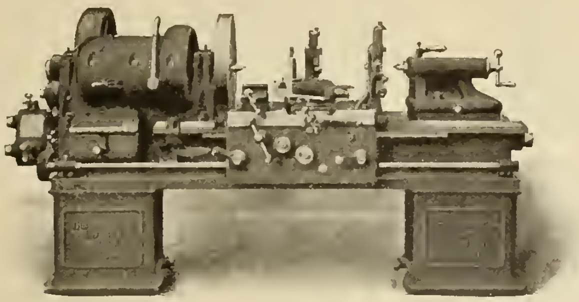
136 LIBERTY ST., NEW YORK, U.S.A.

28 inch New Model Pond Lathe

Agents for Canada

The Fairbanks Co.

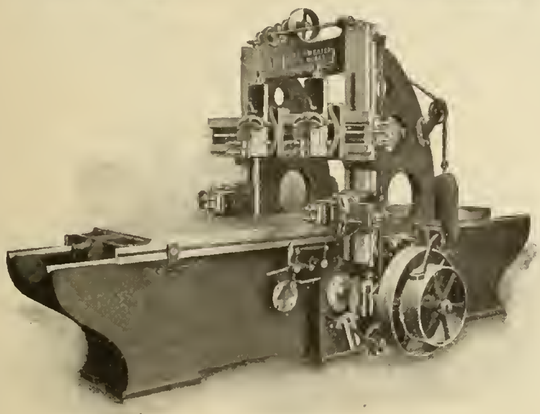
Montreal, Toronto, Winnipeg and Vancouver



LATHES

14 in. to 60 in. swing.

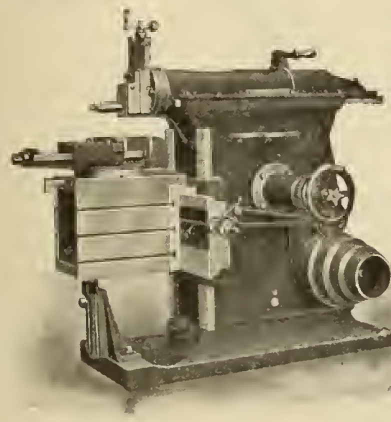
A 20 in. "American" Lathe with Patent Geared Head recently removed 7.52 lbs. of cast iron in one minute. An ordinary 20 in. lathe, tested to the limit, removed from the same bar 2.56 lbs.—a ratio of almost **3** to **1** in power delivered at the cutting tool.



PLANERS

22 in. to 72 in. between housings.

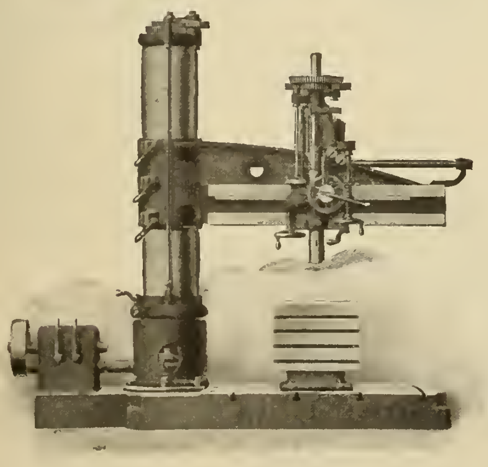
"American" Planers are built for high speed planing, and operate continuously in our works at cutting speeds of 20 ft. to 60 ft. per minute, dependent upon conditions.



SHAPERS

16 in. to 28 in. stroke.

The "American" Shaper is not a tool-room machine, but a manufacturing machine with a cutting power exceptional in a shaper. It is susceptible of fine and positive adjustments without stopping the machine.



DRILLS

RADIAL DRILLS—3 ft. to 7 ft. arms
UPRIGHT DRILLS—
13 in. to 42 in. swing.

The "American" 4 ft. Radial drills a series of 15 holes, ranging from $\frac{1}{2}$ in. to $3\frac{1}{2}$ in. diameter through a 1 in. cast iron plate in **25 minutes**—the record for rapid drilling.

WE EQUIP ANY OF OUR MACHINES WITH IMPROVED ELECTRIC MOTOR APPLICATION.

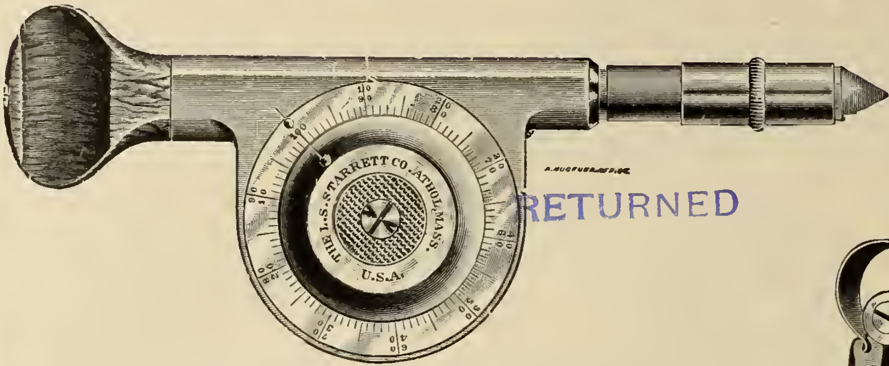
THE AMERICAN TOOL WORKS CO.

CINCINNATI, U.S.A.

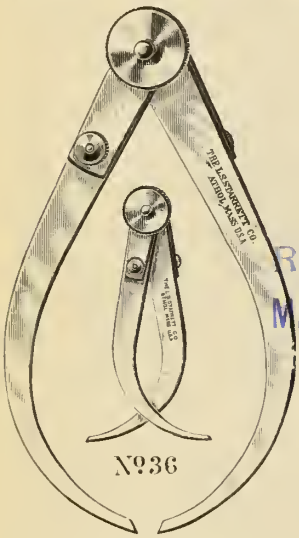
MACHINISTS' TOOLS

WE CARRY A FULL STOCK OF ALL THE NEWEST TOOLS.

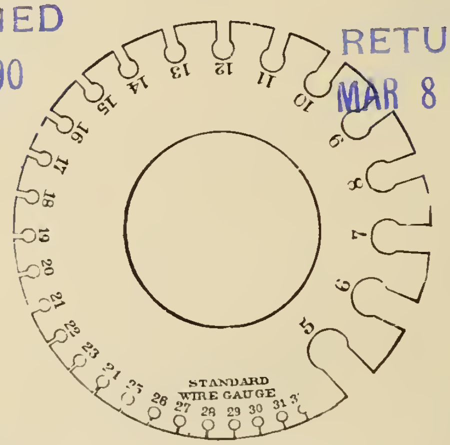
MACHINISTS CAN BE SUPPLIED FROM STOCK With All Kinds OF SUPPLIES.



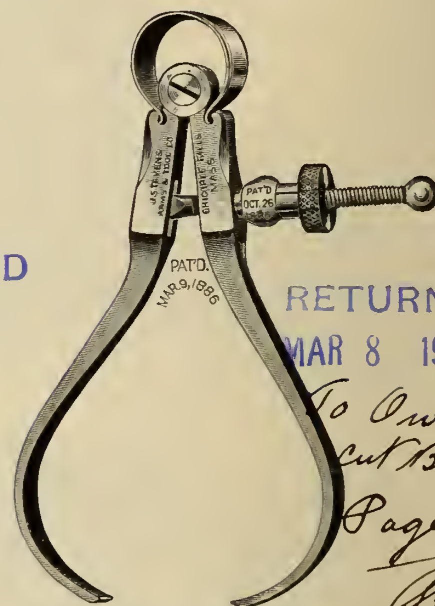
SPEED INDICATORS



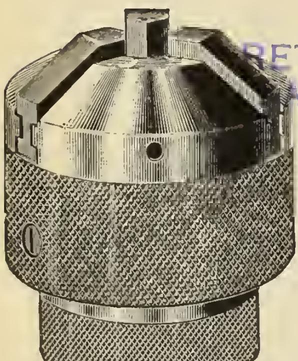
CALIPERS
all sizes



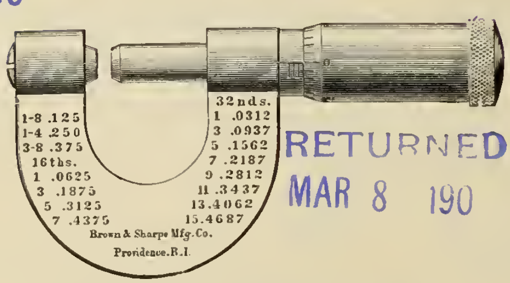
WIRE GAUGES



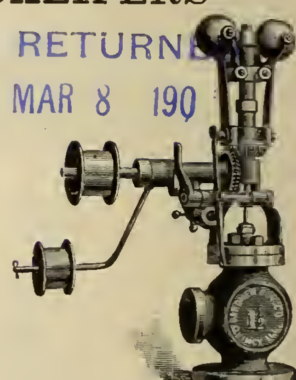
CALIPERS



CHUCKS



MICROMETERS



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Write for catalogue and prices.

RICE LEWIS & SON

LIMITED

TORONTO.

Over Seven Thousand Pounds of mixed grain chopped fine in one hour.

This is the Record of

THE CHAMPION FEED MILL

In the same mill, under exactly similar conditions, the largest and best attrition mill made in Canada chopped 4,200 lbs. of mixed grain in one hour—a difference in favor of THE CHAMPION of nearly 70 per cent. In THE CHAMPION only one plate runs.

REMEMBER—THE CHAMPION FEED MILL is sold on trial, and unconditionally guaranteed to give perfect satisfaction. Our motto is "*Satisfaction, absolute satisfaction, or no sale.*"

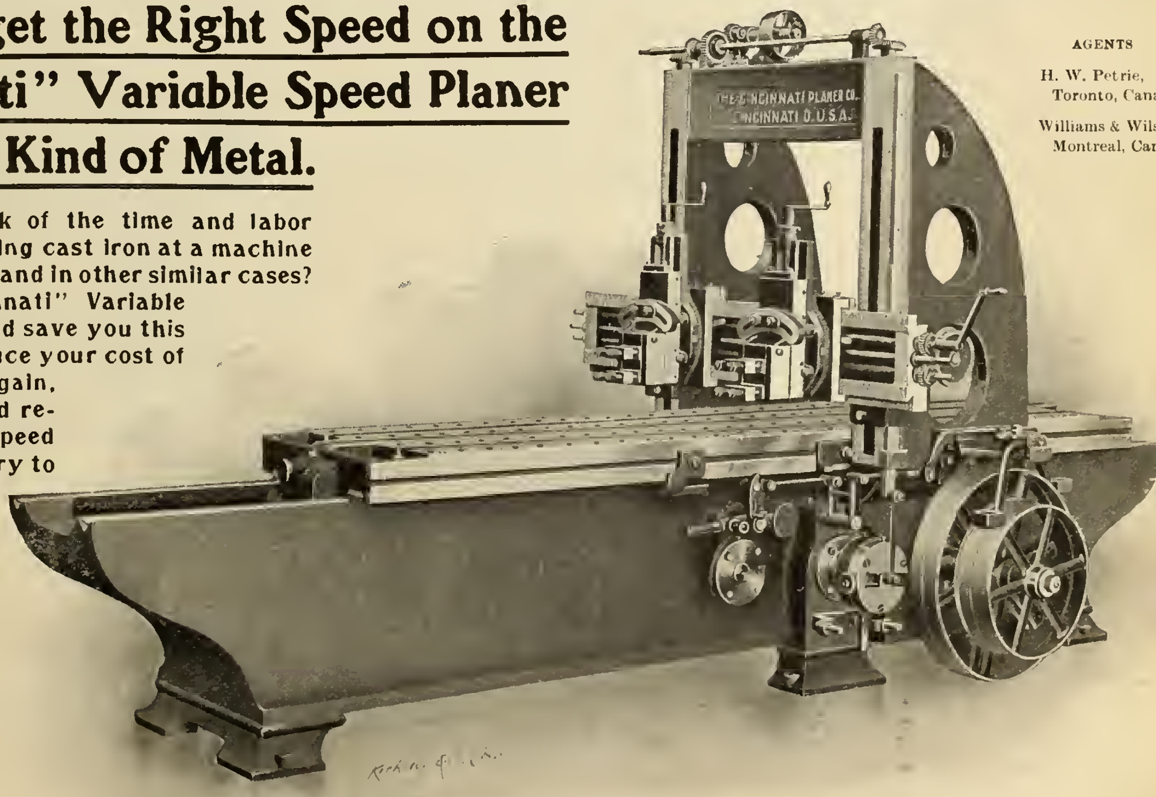
Write for prices and further details.

S. VESSOT & CO.

98 East Front Street, :: TORONTO.

You can get the Right Speed on the "Cincinnati" Variable Speed Planer for Every Kind of Metal.

Did you ever think of the time and labor wasted when planing cast iron at a machine steel cutting speed and in other similar cases? Well, the "Cincinnati" Variable Speed Planer would save you this time, and thus reduce your cost of production. Then again, in order to get good results from high speed steel, it is necessary to have variable speeds. Investigate the "Cincinnati," the planer that will give speeds from 15 ft. to 70 ft. per min. Send for the Catalog and read all the time and labor saving features.



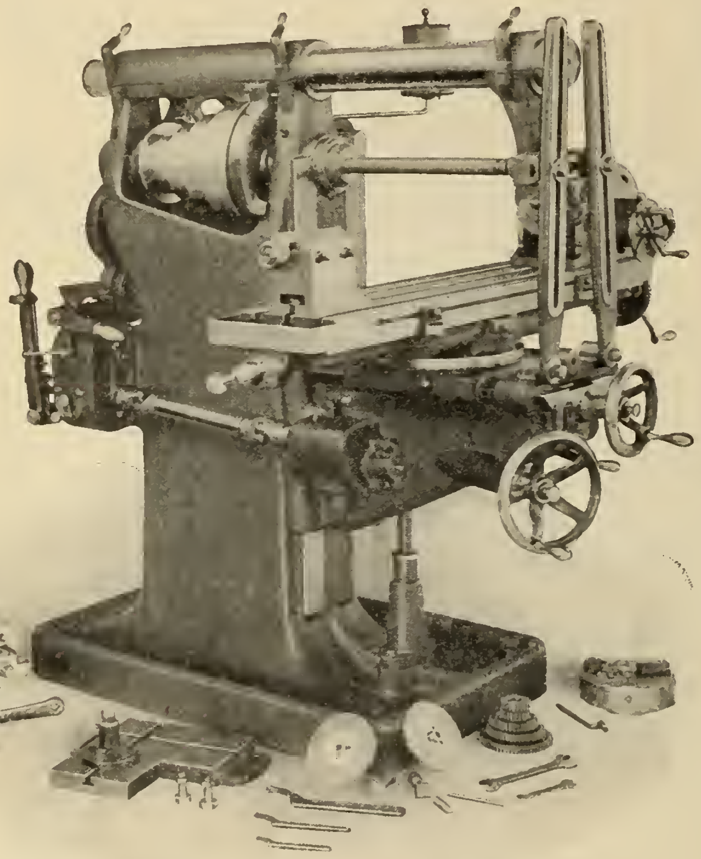
AGENTS

H. W. Petrie, Toronto, Canada

Williams & Wilson, Montreal, Canada,

The CINCINNATI PLANER CO., Cincinnati, Ohio.

Becker-Brainard



No. 3. Gear Feed Universal Milling Machine

Milling Machines

easily demonstrate their superiority when in constant hard service and when using high speed cutters.

We are glad to have the high-grade construction and design of these machines carefully investigated and compared with other makes.

Time estimates will be promptly furnished on request, but the more satisfactory way is to let us make a practical test on your own work, as this enables us to submit actual figures and furnish convincing proof that

Becker-Brainard Milling Machines

show the highest rate in production of any modern milling equipment.

The Gear Feed Mechanism is compact and positive, furnishing complete range of twenty changes.

Gears are made of steel.

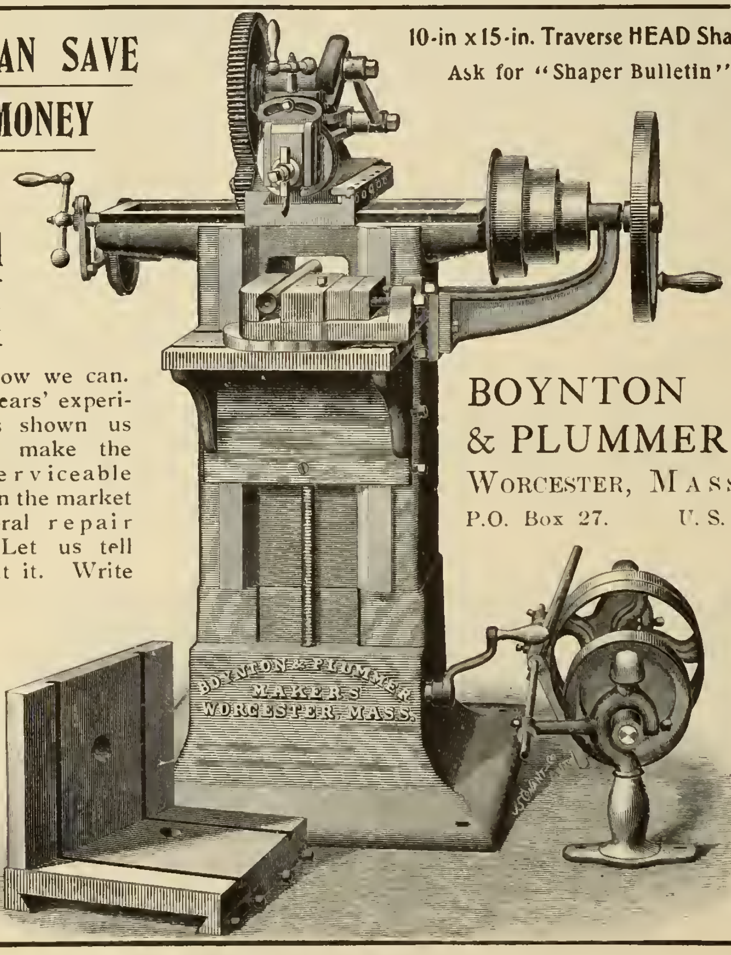
Hand Wheels and Levers for operating are all at front of knee within convenient range.

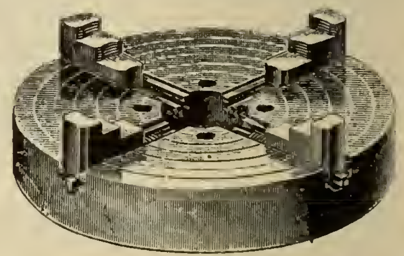
Secure full information regarding merits of these machines before purchasing.

Becker-Brainard Milling Machine Co.

HYDE PARK, MASS., U.S.A.

Canadian Agents: A. R. WILLIAMS MACHINERY CO., Toronto and Montreal 255


BOYNTON & PLUMMER
MAKERS
WORCESTER, MASS.



THE FAIRBANKS COMPANY

Canada's Leading Machinery and Supply House

We are Canadian Selling Agents for:

Niles-Bement-Pond, Pratt & Whitney, J. J. McCabe, Brown & Sharpe, American Wood-Working Machinery Co., American Tool Works Co., Merrell Mfg. Co., E. W. Bliss & Co., Bignall & Keeler, S. A. Woods Machine Co., Reliance Machine Tool Co., Wilmarth & Morman.

We have in stock the following Second-Hand Tools:

LATHES

One 28″ x 12′ Bertram Engine Lathe, with Plain Rest and Chuck.
One 20″ x 8′ Gardner Engine Lathe, with Plain Rest and Chuck.
One 18″ x 8′ Bertram Engine Lathe, with Compound Rest and Chuck.
One 16″ x 10′ Draper Turning Lathe, with Chuck.
One 16″ x 6′ Draper Turning Lathe, with Chuck.
One 16″ x 6′ Gardner Engine Lathe, with Chuck.
One 20″ x 6′ Draper Turning Lathe, with Plain Rest.
One 20″ x 14′ Draper Shaping Lathe.

PLANERS

One 24″ x 24″ x 5′ Pond Planer, with Single Head.
One 24″ x 24″ x 6′ Pond Planer, with Single Head.
One 44″ x 44″ x 12′ Bertram Planer, with Two Heads on Cross Rail.

MISCELLANEOUS

One Norton Emery Wheel Grinder, 16 x 3″ Wheels.
One Buffalo Stationary Forge, Size of Pan 17 x 48, with Hood and Stack.
One Hurlburt & Rogers No. 3 Cutting-off Machine, capacity 3″.
One Northy Air Compressor.
Two Rumblers.
One Flather Floor Vise.

THE FAIRBANKS COMPANY

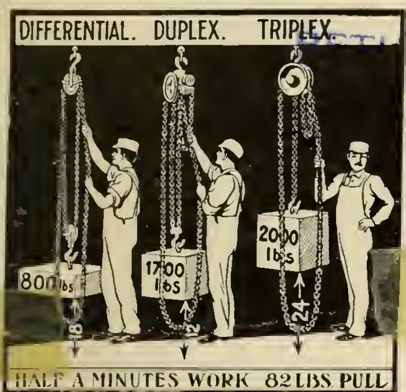
Montreal Toronto Vancouver Winnipeg

THE FAIRBANKS COMPANY

SMALL TOOL DEPARTMENT

Below we illustrate a few of the lines we carry in stock. We believe we carry the largest stock of machine shop supplies and small tools in Canada, and our shipping facilities are unexcelled.

YALE & TOWNE, Chain Blocks

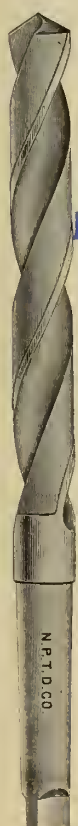


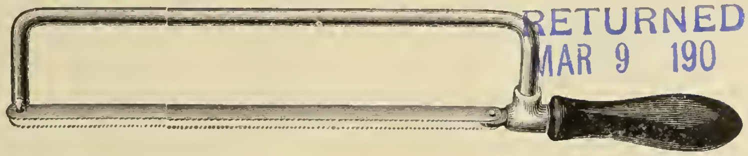
SOLE CANADIAN AGENTS.

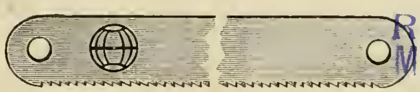
We are Canadian Sales Agents for

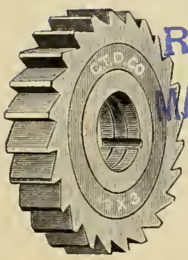
- Yale & Towne Mfg. Co.
- Pratt & Whitney Co.
- McCroskey Mfg. Co. (Adjustable Reamers.)
- West Havens Mfg. Co. (Hack Saw Blades.)
- New Process Twist Drill Co.
- Hill Tool Co. (Small Tools and Holders.)
- J. H. Williams (Drop Forgings.)
- Norton Emery Wheel Co.
- Champion Forge and Blower Co.
- Union Chuck Co.
- Prentiss Vice Co.
- Wiley & Russell Mfg. Co.
- Emmert Vice Co.
- Warner Instrument Co.
- Oster Mfg. Co.
- Reed Mfg. Co.

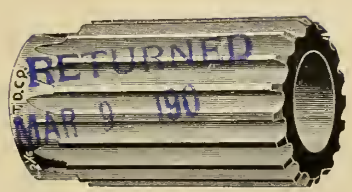
SOLE CANADIAN AGENTS.

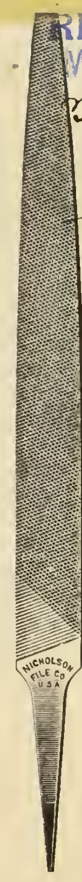












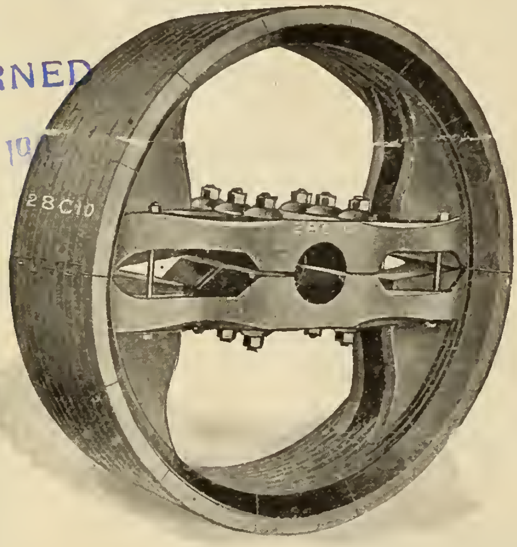
Catalogs of any of the above lines will be mailed upon request Mail orders filled the same day as received.

THE FAIRBANKS CO.

Montreal **Toronto** **Vancouver** **Winnipeg**

A Power Transmission Combination
HARD TO BEAT

FAIRBANKS
WOOD SPLIT
PULLEY



MADE IN CANADA

In the construction of Fairbanks Wood Split Pulleys strength is the first consideration. Each piece of wood forming part of the rim is glued and nailed with three coated nails, making the join even stronger than the wood itself. The arm is anchored to and forms part of the rim, being also glued and nailed therein in the same manner as a separate piece of the wood would be. This eliminates all possibility of the pulley breaking, or, as is commonly called "bursting," and our four point bushing gives a grip on the shaft that never loosens up. These desirable features make

Fairbanks Wood Split Pulleys

the very best pulleys manufactured to-day.

For those whose Belts are giving them trouble, or who would like to get a better quality of Leather Belting than they ever could before, Fairbanks F Brand Leather Belting is manufactured.

Nothing but the very best packers' hides are used in the manufacture of our belting. The lower part of the belly and working parts are not made into Belting, as we take a strip four feet long and fifteen inches each side of the back bone from each butt, as shown in above cut. This is the only manner in which to obtain uniformity both in thickness and toughness. We carry a full stock of all sizes in stock and guarantee this Belt superior to any other manufactured.

THE FAIRBANKS COMPANY

Montreal **Toronto** **Vancouver** **Winnipeg**

Modern Canadian Manufacturing Plants

Article II. Waterous Engine Works, Brantford, Ont.

IN contrast to the style of plant in Canada that has sprung up within the near past, is another class, established years ago, the story of whose progress has been coincident with the growth and development of the country, and in which expansion has been sure and steady, with rapid strides during the past few years. Many of these have passed through all the stages of evolution necessary to keep pace with the march of mechanical progress, so that they may be found to-day in the front rank of industrial establishments. Few firms can point to sixty years of continuous manufacture, so that the record of the Waterous Engine Works Co., established in 1844, puts it in a class occupied by few others. In the early years they met the demand for saw mills by building the old Muley, or up-and-down mill. Later this was superseded by the first circular saw mill, the first one built in Canada being turned out from these works. They were also pioneers in introducing the band saw mill, which has come into such general use, and is displacing both the circular and the gang saw. The Waterous steam fire engine is well known in Canada, and a description of the place in which these are manufactured should be of general interest.

When in the year 1894 the old premises, which were opened in 1844, became too cramped, the company laid out plans for modern shops and located in a part of Brantford where they could get direct railway sidings from both railway lines, the G.T.R. and T.H. & B., which latter runs in connection with the C. P.R.

Main Shop—Waterous Engine Works.

Main Shop.

The main machine shop faces Market street and the T.H. & B. tracks. The building is 300 ft. long by 120 ft. wide, with a centre space 40 ft. wide by 38 ft. in height. The side wings, each 40 ft. wide, are two storeys high. The building is well lighted from both sides and from lights next to the crane track, and in addition there are skylights, making the main floor very bright and giving that desired light from the top.

The centre floor is devoted to the erection of large machines. A 20-ton electric traveling crane runs the entire length of the building. Numerous jib cranes with air hoists fastened against the posts assist the traveling crane and command most of the heavy tools. The side wings on the main floor are occupied by the smaller tools.

The front part of the main building is taken up by the offices. On the ground floor are located the superintendent's, timekeeper's and shipper's offices. The second floor contains the main offices and drawing office. The third floor contains the photograph and blue print studios.

On the second floors of the side wings are the pattern shop, millwright department and the fitters of light machinery. The drawing office is situated next to the pattern shop, and a bridge gangway runs from the pattern shop to the foundry, connecting the three departments very closely.

Foundry.

The foundry is 200 ft. long by 80 ft.

wide, with a centre space 40 ft. wide by 23 ft. high, devoted to heavy castings. This building is lighted from both sides and from lights overhead, making it a very bright and cheerful shop. A traveling crane and numerous jib cranes, facilitate the work and handling of heavy castings and ladles. In the centre of the main aisle a narrow gauge industrial railroad connects the two ends of the foundry with the casting cleaning department and from thence leads into the machine shop.

Boiler Shop—Waterous Engine Works.

In the north end of the foundry are placed the core ovens, of which there are two large ones and several small ones, not forgetting a Millett core oven.

There are two cupalos located in the centre of the building in connection with which are a hoist for beinging up the pig iron and coke to the eharging platform, and in a separate building the engine and fan for providing the air.

A traveling crane runs crosswise of the foundry into the yard. This is designed for the purpose of handling flasks.

Next to the foundry are the sheds for the coke and sand.

A complete brass foundry with three furnaces, air hoists, castings tumblers, and all kinds of air tools, constitutes the equipment of the foundry.

Adjoining the foundry is the pattern storage room, a three-storey building 80 x 36 ft. long, built perfectly fireproof, in which the patterns are kept.

Foundry—Waterous Engine Works.

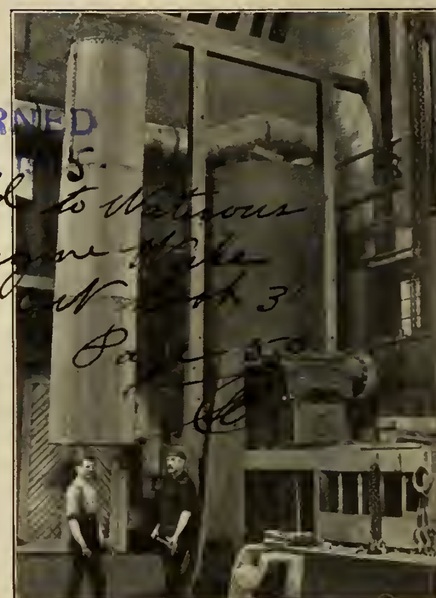
Blacksmith Shop.

Adjoining the maehine shop is the blaeksmith shop, 50 ft. wide by 100 ft. long, containing eighteen fires and two steam hammers, besides a large forging maehine, bull dozer, riveter for speeial chain, shears, and other appliances used in a blacksmith shop.

Machine Shop.

Next to the blacksmith shop is found the boiler shop, a building 80 ft. wide by 200 ft. long. In the main aisle, which is 40 ft. x 23 ft. high, the large boilers are erected. A twenty-ton electrie traveling crane runs the entire length of the shop. At one end of the building is the riveting tower, which also eontains the crane for riveting machine, hydraulic pumps, and aceumulator.

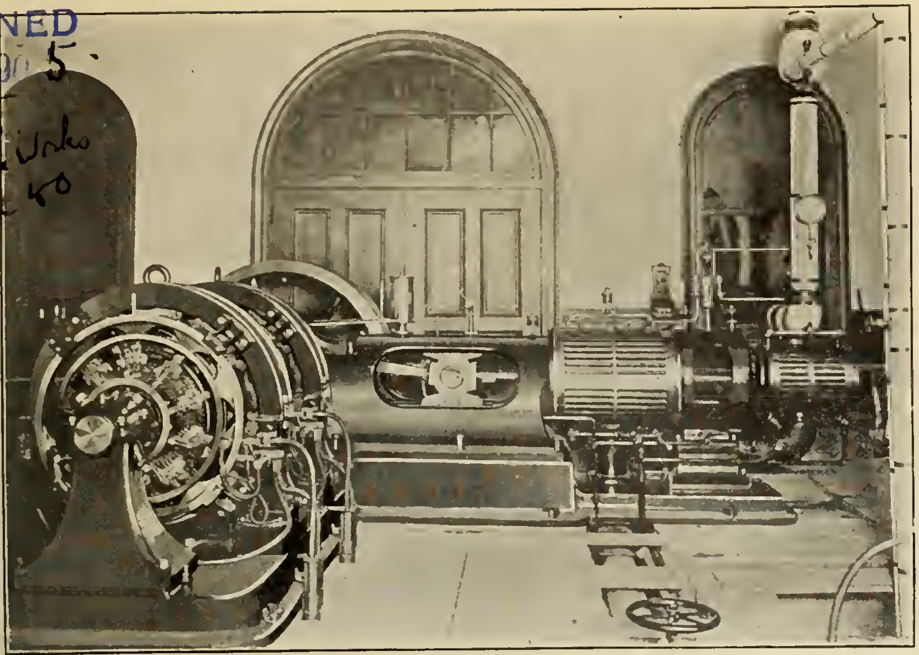
In the 40 ft. wide wing, where the laying out, flanging and maehining of plates is done, are very powerful bending rolls, large enough to bend one and an eighth inch steel plates. Smaller bending rolls of a capacity for $\frac{5}{8}$ to $\frac{3}{4}$ inch plate are placed next to these. Heavy punches, drills and flanges finish the equipment.



Flange Punch—Hydraulic Riveter.

Boiler and Engine Rooms.

The power is supplied by five boilers. They consist of one water-tube boiler of 150 h. p. capacity, two return tubular boilers of 125 h. p. each, and two internal corrugated furnace boilers of 150 h. p. each. The company installed different kinds of boilers for the purpose of making experiments and tests at home. Not only the different types of boilers have been tested, but also the way of setting them and firing them with different furnaces, Dutch ovens and stokers,



Engine Room—Waterous Engine Works.

so that they are in the position to give customers the benefit of their own experience in selecting boilers.

In the engine room is found a large, single cylinder non-condensing engine of 175 h. p., for the purpose of driving the shafting in the main shop, one McEwan engine connected to a 25 k. w. generator to supply the electric light, and another 25 k.w. generator supplies the electricity for the traveling cranes. A large direct-connected steam air compressor with receiver occupies a part of the engine room, supplying the air tools and air hoists with the necessary compressed air.

Warehouse.

Owing to the large foreign trade that this company does and which necessarily means the shipping of a whole saw mill outfit, comprising sometimes 10 to 15 carloads at one time, it was found necessary to erect a new warehouse last Summer. This is a building 80 ft. wide by 200 ft. long.

Output.

In addition to the lines already mentioned, the company makes and erects complete saw mill equipments, pulp mill machinery, engines, boilers, brick machinery, elevators and conveyor machinery, chain belting, veneer machines, road rollers, etc. In some of the largest mills in Quebec may be seen installations of Waterous grinders, screens, rossers, semi-automatic cut-off saws, and conveyors of latest design. The engine and boiler department are turning out installations which are being placed throughout Canada. The fire department builds steam fire engines from double extra first of 1,300 gallons per minute, to the small village size of 450 gallons.

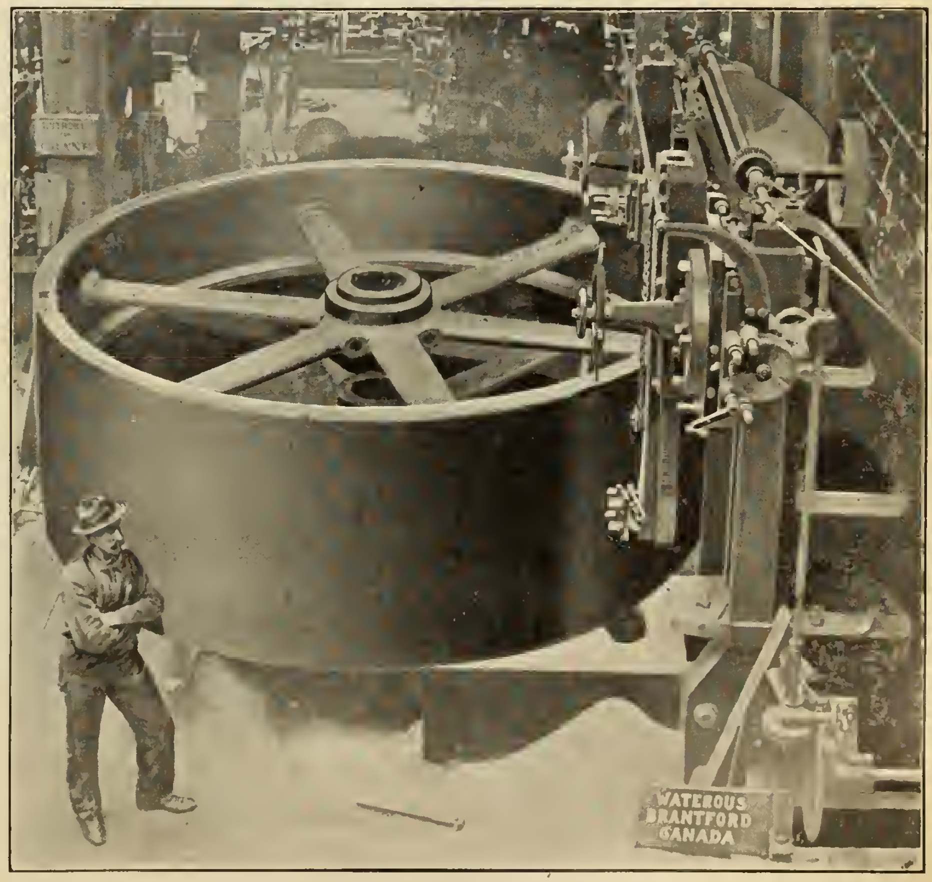
Illustrations are shown representing some heavy work done by this company as well as views of the different departments.

The first automobile fitted with fare-registering instrument has been sent for hire in the Paris streets by the Societe des Taximetres. Its body resembles that of the ordinary four-wheeled cab.

DISCOVERY OF PROCESS FOR MAKING HARD RUBBER.

THERE was once a machinist named George, who worked at the bench and was always more interested in hearing the quitting-time whistle blow than in any other event of the day, says Locomotive Engineering. One day the first yell of the whistle found him with his hammer in the air, and being alarmed lest he should make even part of a stroke beyond working hours, he permitted the hammer to fall and it broke a bottle containing a certain chemical which happened to be on his bench and the chemical ran over a sheet of rubber that also was on the bench. To wipe up the mass after the whistle had blown was not the way George did business, so he went home. In the morning when he examined the rubber that had soaked all night in the chemical he found that it was as hard as a piece of board.

Here now came in the worldly wisdom of this machinist. George, before long, reflected that the change in the consistency of the rubber was due to the chemical that had been anointing it all night. Then the question occurred, Would hard rubber have any value as an industrial product? The secret of how to make hard rubber was carefully guarded, a company was formed to put articles made from it upon the market and the discoverer is now a multi-millionaire.

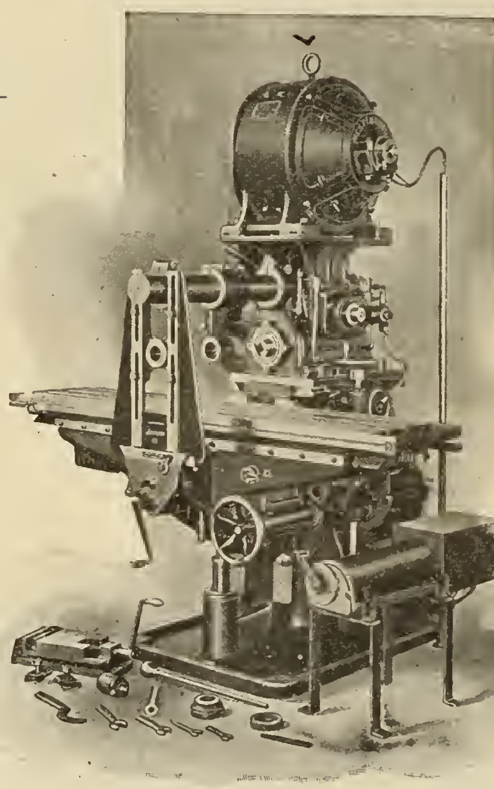


Some Large Work—Waterous Engine Works.

Electric Drive for Machinery.

MUCH has been written of the advantages which may be derived from the installation of electric motors in machine shops and other industrial plants. The fact that certain advantages are attached to the electrical distribution of power has been long recognized by the electrical fraternity as a whole, but the shop manager or superintendent is usually so engrossed in more or less arduous executive duties that he has neither time nor inclination to go into the problem of electric drive to the same extent as those directly interested in its application.

Text books on electric motors give more or less clearly the means of determining the characteristics of motors, but the busy man has little time to go into the problem from this point of view. The electric motor to many outside of the electrical fraternity is shrouded in mystery, and after a careful, painstaking perusal of a more or less technical article upon electric driving they feel that the shroud is heavier than before. In other words, an article of this character has a tendency to confuse managers and superintendents rather than to place in their hands means of intelligently determining for themselves just what advantages might be derived from the installation of motors in their plants. It is the intention of this article to place in the hands of such managers and superintendents the general characteristics and behavior of motors as applied to machine tool work, with the belief that this treatment will reach many to whom the electric motor has been more or less of an enigma.



Brown & Sharpe Milling Machine driven by Type S Westinghouse Motor.

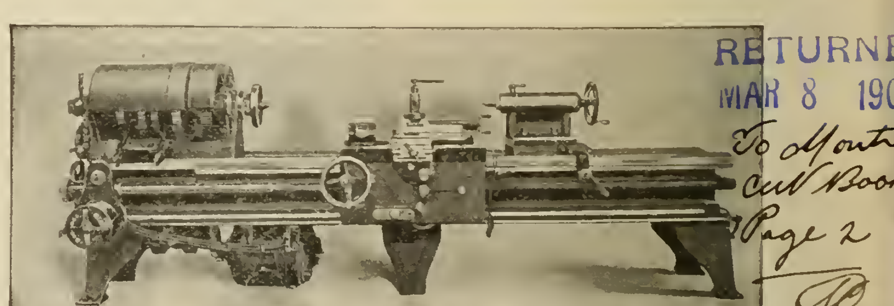
The electrical drive has been advocated by the manufacturers of electrical apparatus so long and so many notable installations have been made that the general subject has become more or less familiar to everyone. There is, however, no problem confronting industrial establishments and machine shops to-day which is worthy of more careful consideration.

Adaptation.

Managers and superintendents have been somewhat slow in adopting the electric drive, partly because they have not recognized its advantages and partly because the electric motor has been regarded as a rather delicate piece of apparatus. This latter view is not without some foundation, for the early motors were crude and weak mechanically and the electrical features were but little understood, even by those to whom their design was entrusted. The motor of to-day is a vastly different machine from that of ten years ago. Sturdy in mechanical construction and liberal in electrical design, it is being used for many classes of service which ten years ago would have been considered impossible.

In the machine shop and manufacturing plant the electric motor is to-day effecting economies in operation and an increase in production to a marked degree and the time is not far off when the plant adhering to the older method of driving must fall behind in the race for commercial supremacy.

The conventional mechanical equipment of the manufacturing plant comprises an engine, located as centrally as conditions will permit, connected by belts to one or more line shafts which must be of considerable diameter near the engine, in order to transmit the power, and may also be of considerable length. Since the early days of power transmission, belts and shaftings have been used for this purpose. Given a small amount of power to be transmitted over a short distance there is probably no way in which such a transmission



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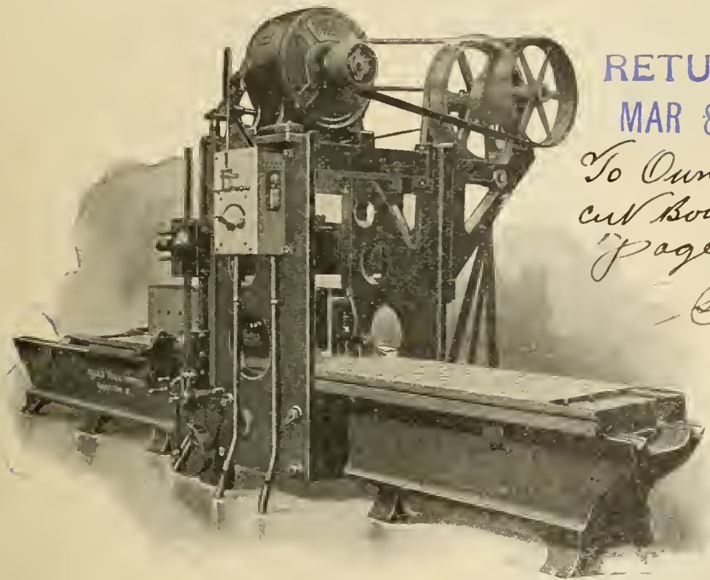
Engine Lathe driven by Westinghouse Motor.

can be more cheaply or simply effected than by the employment of a belt and two pulleys. The arrangement is simple mechanically, may be maintained by the average mechanic, involves no new principles of engineering, and in cases where the drive is not more complicated than outlined above, is the method which has been proven by years of experience to be entirely satisfactory. The belt introduces between the driving and the driven machines, a flexible element which, in case of accident to the driven machine causing it to "stall," will slip and may save considerable damage.



14-foot Planer driven by Westinghouse Motor.

Relative Cost.

The principal objection to the installation of electric motors in a plant has been largely one of expense, and in order to properly valuate this expense those responsible for the adoption or rejection of motors would do well to make a careful comparison between the cost of the plant electrically driven and the same plant driven by mechanical means. In figuring the cost of equipment the problem should be considered from a broad standpoint. There are certain economies in the construction of the building due to the installation of electric motors, and certain other economies which refer to the cost of operating. These will be discussed separately.

The first comparison of cost in the case of a contemplated factory should be, of course, between the price of belts and shafting, and the price of the motors and the reduced amount of shafting, if grouped drive be used, or the cost of the motors and controlling apparatus where the machines are to be separately driven.

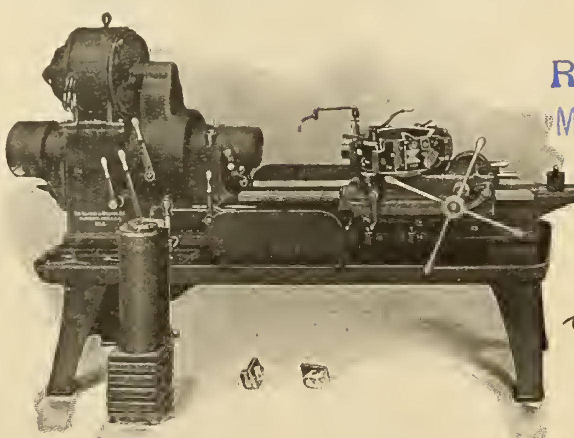
When directly driven tools are used, the cost of overhead building construction is materially lessened and if group drive is used the shafts are shorter and lighter, thereby reducing the cost of supports and foundations as compared with a direct belt drive, with heavy line shafts and large belts.

The lighting of an industrial plant is a problem which cannot be given too much consideration in laying out a new plant. Illumination depends upon two factors, first, the area of unobstructed windows, and second, the lightness of color of the interior of the shop. Belting makes both of these conditions difficult to maintain, due to the fact that it seriously obstructs the path of the light from the windows to the various machines and also agitates dust and dirt, which is finally deposited on windows and walls, giving them a dingy color. The effect of the color of the interior of the shop upon the general illumination can not be over-estimated. It may be stated in a general way that white walls and ceilings improve the quality of the light and their general effect upon the illumination is little short of marvelous. The same reasoning applies to artificial illumination. Not only will the amount of lighting facilities necessary be reduced if the electrical drive is used, but a general improvement in the efficiency of the lighting will be assured.

Advantages.

Overtime work is necessary in almost all industrial establishments. Repair shops, such as railroad and general machinists, are the greatest sufferers on this account. The railroad shop especially always has a force of mechanics on hand holidays and nights. In the case of the mechanical drive the complete line shafting must be run in order to permit the use of a single machine tool. This presents an interesting contrast to the individual tool or small group drive where practically only the tools in actual use are consuming power. With the electric drive two solutions to this problem are possible, first, group drive, and second, individual drive.

With the group drive it is evident that the shop may be divided into sections. Tools which are liable to be in operation at the same time may be belted to the same line shaft and thus only the section or sections from which overtime work is required need be put into operation; the remaining tools in the shop, standing idle, will consume no power. In the particular group in which the machines are being operated only a short length of shafting of comparatively small diameter need be driven, while in the case of the purely mechanical drive the transmission losses will be



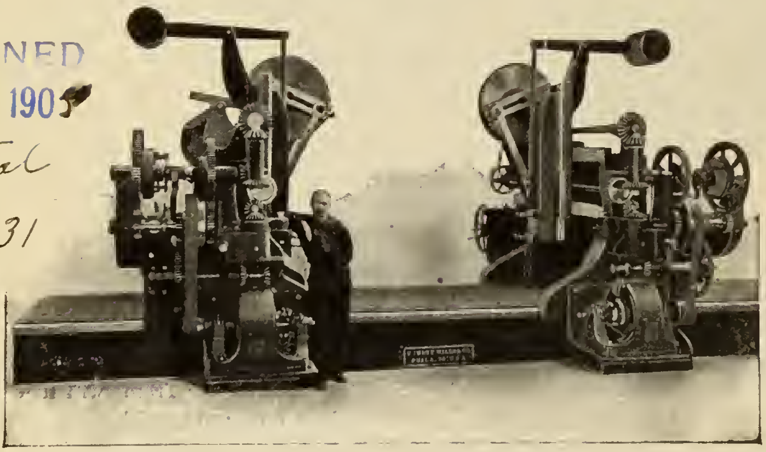
Type S Motor driving Hollow Hexagon Turret Lathe

nearly as great as they would be with the whole plant in operation.

The individual drive goes a step farther. With this system each machine tools has a separate motor and may be located wherever it is deemed advisable. Under these conditions any tool, even in the most remote part of the shop, may be operated and it will draw from the power house only the energy required to drive that tool and to perform the necessary work on the material. If occasion demands, the smaller tools driven by individual motors may be carried to the round house or to a convenient part of the shop, thus saving considerable time in the matter of transporting the material to and fro. A pair or at most three wires are all that is necessary to convey power to drive the machine.

In the mechanically driven plant, if shafting and foundations are not sufficiently rigid, and if belts, shafting and foundations are not properly maintained, mechanical conditions may arise which will cause serious friction losses. If the belts are run at too great a tension the shafting is liable to be pulled out of alignment, thus subjecting the shafts and bearings to considerable strains other than those due to simple transmission of power. If, on the other hand, the belts are allowed to run too loose, slipping will result, giving not only unsteady speed at the producing machines but entailing considerable loss of power. Under average conditions the horse-power wasted in driving belts and shafting is astonishingly large. Local conditions vary so much that it is impossible to give a figure which will fairly represent these losses. It may be said, however, that the percentage of the total horse-power output of the engine which is actually useful at the productive machines varies from 22 to 77 per cent. It should be noted that these percentages are figured on the basis of the horse-power required to drive the shafting and belting when running light. There is good reason to believe that these losses increase with the increase in load, but the amount of this increase is an extremely intangible quantity and up to the present the data regarding it is very meagre. Where the demand for power is intermittent, as in the case of a machine shop probably not over 40 to 50 per cent. of the power produced by the engine is utilized by the machine tools, the remainder being wasted in driving line shafting, belts, etc.

Too much stress cannot be laid upon the importance of economic transmission. While the cost of power is but a small percentage of the total cost of the product, the possibility of effecting a reduction in this item of expense should not be passed over lightly. There are, however, other features in connection with efficient transmission which may be of the utmost importance. If the line losses in transmission are large, the size of the engine and boilers must be large in comparison to the work to be done.



Motor Driven Double Slotting Machine—Westinghouse Motor.

Increased Production.

As an example of this take the case of a plant requiring 500 horse-power at the productive machines. Assume that the efficiency of the mechanical drive is 50 per cent. and that the electrical system has an efficiency of 75 per cent. If mechanical transmission were used, 1,000 horse-power would be required at the engine. If the electrical drive were used under the conditions given above, 667 horse-power would be required at the engine. If then this plant were transformed from mechanical to electrical drive there could be delivered to the productive machines from this 1,000 horse-power engine 750 horse-power. This represents an increase in the horse-power of new productive equipment of 250 horse-power or 50 per cent.

Within recent years there have been introduced into the machine shop the so-called high speed tool steels. The revolution which they have caused in manufacturing has only begun.

In order to obtain the necessary varia-
In order to obtain the necessary variations in speed many extremely ingenious variable speed devices have been placed upon the market. It is a fact, however, that not a single mechanical variable speed device on the market to-day is entirely satisfactory.

The question frequently arises as to whether the new tool steels require fine increments of speed in order to utilize them to the best advantage. The answere to this is emphatically "yes." With a certain material and a certain tool steel, assuming that the shape of the latter be correct, a certain area of cut may be removed at a definite cutting speed.

The solution lies in the use of the electric motor. The keynote to the success of the electric motor in the machine shop, so far as the individual drive is concerned, is, as stated above, not so much economy in operation, but rather the fact that small variations in speed may be made under load with but little manual effort on the part of the operator.

Realizing the importance of electric drive for machinery, the Westinghouse interests were among the first to give this branch of the art special attention and they have developed a system which is remarkable for reliability, efficiency and ease of control. Their system is installed to the extent of several thousands of horse-power in the largest factories in the United States and they also have numerous large installations in Canada, among which are those at the Locomotive and Machine Co., Montreal; Canadian Pacific Railway shops, Winnipeg; Grand Trunk Railway Stratford shops; Canadian Colored Cotton Mills, Hamilton; Toronto Carpet Mfg. Co., Toronto; and Pere Marquette Railway shops, St. Thomas. The Canadian Westinghouse Co., Limited, of Hamilton, Ont., are just completing one of the most complete and modern electrical manufacturing plants in the world and will very soon be building a full line of electrical apparatus of the highest grade, including complete system for electric machine tool or group drive.

Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

EFFECT OF LOAD FACTOR ON COST OF POWER.

THE great desideratum for an electrical system is a high-load factor with consequent greatest return on investment, load factor being the ratio of average to maximum load. All the factors of expense included in cost of power to the consumer are then operating at maximum economy and cost of power is at a minimum.

The lighting of residences and offices produces a peak on the late afternoon and evening, with but little load the remainder of the twenty-four hours; consequently the average load on the plant with lighting only is very small and the load factor low. A commercial motor load in connection with lighting will increase the average load even though causing a greater peak. The addition of a street railway load still further increases the day load, but in consequence of the heavy demand load during rush hours when the public is going to and from business, which occurs at the peak of the lighting load, the peak load on the plant is greatly increased. This heavy peak, with but a small average load over the twenty-four hours, produces a low-load factor, and a portion of the machinery being shut down a greater part of the time, higher rates must be paid by the consumer to secure a certain return on first investment than when the load factor is higher.

The storage battery is evidently a means in the hands of the power-producing company of increasing the average load on the machinery. By charging the battery during light load and discharging during periods of heavy load, a more constant load on the generating apparatus is produced, with consequent better efficiency, and at the same time acting as a reserve in case of accident in the power plant. Unfortunately the battery is expensive, and a loss occurs in its operation which greatly reduces the higher efficiency secured by the increased load factor. The great benefits obtained by its use are reserve capacity and voltage regulation, enabling the use of more efficient lamps.

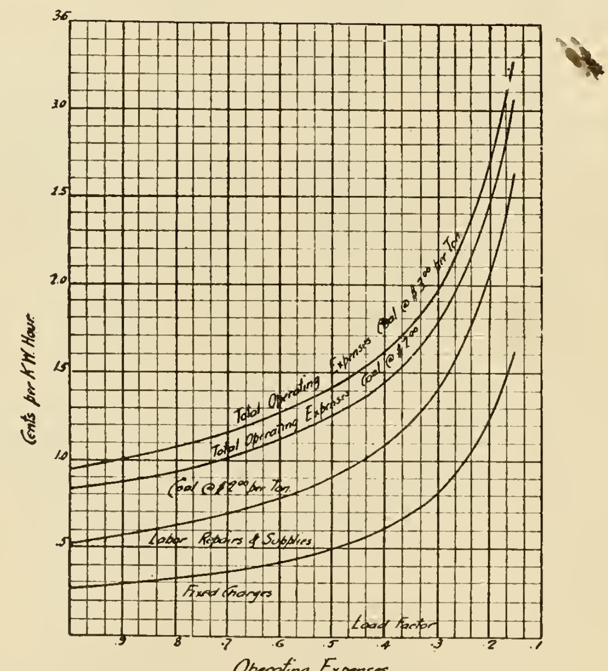
The cost of distribution is constant with various load factors in so far as the fixed charges and maintenance are concerned. The losses in distribution, however, vary, these consisting of losses in lines, transformers if alternating current is used, meters, losses in grounds and losses from theft of current; all decrease the output and accordingly increase the cost to the consumer. While it is possible to determine fairly accurately the losses in lines, transformers and meters with varying load factors, the losses from grounds and theft are indeterminate and require constant attention to keep them within certain limits. Yet as a rule these latter will become a smaller percentage of the total output the higher the load factor.

There yet remains for consideration the effect of the load factor on the actual cost of production of energy.

The higher the load factor, the greater is the amount of power produced, the longer does the apparatus operate most efficiently, the lower the ratio of fixed charges to total operating expenses and consequently the lower the cost of power per unit.

To determine exactly in what proportion the cost of power is decreased, it will be necessary to assume a plant, determine the fixed variable charges, and thereby the cost per k. w. hr. at various load factors.

An example is taken of a plant with a peak load of 750 k. w. Allow three units of 300 k. w. capacity each, so that in case of a breakdown to one, the other two may take care of the peak with an overload of 25 per cent. on each and sufficient boiler capacity for the same contingency. No provision is allowed for stokers, coal handling apparatus or economizers. Plant assumed to be on the water front providing sufficient water for condensing purposes. Non-condensing is also considered.



Operating Expenses of 900 K.W. Condensing Steam Plant- Peak 750 K.W

Fig. 1

First cost of plant complete:

Condensing, $118,425.00, equivalent to $131.60 per k. w.; non-condensing, $114,-625.00, equivalent to $127.40 per k.w.

Fixed charges.	Condensing.	Non-condensing.
Interest at 5 %	$ 5,921.25	$ 5,131.25
Taxes and Insurance at 2%	2,368.50	2,292.50
Depreciation Machinery 10%	7,710.00	7,305.00
Building 3%	1,122.00	1,134.00
Total	$17,121.75	$16,462.75

The above first cost being for 100 per

cent. load factor, there will be a varying reduction due to the decreased boiler capacity required on lower-load factors. A point is reached below which it is not advisable to further decrease the boiler capacity, as the peak load must be taken care of and sufficient reserve provided for accidents and repairs; this point being taken in this case at 40 per cent. load factor. The effect of this reduction is to diminish the fixed charges at 40 per cent. load factor by $1,000 per year, or about 6 per cent. of the total.

The cost of labor varies to a certain extent with load factor, but a minimum number of men required to operate the plant is reached at about 40 per cent. load factor, below which this item remains constant. The cost of oil and waste, supplies, water, and repairs varies almost directly with load factor as the greater number of hours per day that the machinery remains in service, the greater do these expenses become, and vice versa. The second line in figs. 1 and 2 is for these charges reduced to the k. w. hr. basis, and is added to the fixed charges curve; the difference between the two curves, therefore, represents the cost of labor, oil and waste, supplies, water and repairs.

The cost of fuel, usually coal, per unit of power generated, varies with some power of the load factor less than one depending upon the number and efficiency of units employed both in the engine and boiler rooms, also upon the cost per ton of coal, its heating value and upon the ability of the firemen to get the best results; it is of the utmost importance to watch this item carefully, as greater economy can be secured in the cost of coal per k. w. hr. than in any other item of expense. The calorific value of the coal should be tested from time to time and compared with the number of lbs. used per k. w. hr.

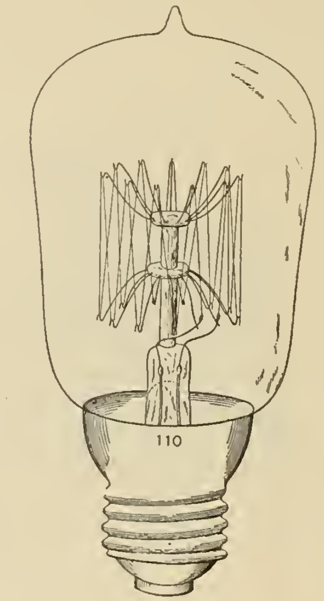
The coal considered is assumed to contain 12,000 b. t. u.'s per lb., and two curves are plotted when the cost is $2 and $3 per ton respectively, the results being added to the two previous curves plotted. These figures of fuel cost per k. w. hr. are above the average usually obtained, and can only be secured by constant attention in the boiler room; for instance, at 40 per cent. load factor in the first case 1 k. w. hr. is generated from 3.5 lbs. of coal from the pile.

The cost of management and distribution is then discussed.

Coal is expensive, and from the nature of things will increase in price, and it behooves us to investigate any methods of producing power which is more economical in the use of fuel than the steam engine, and naturally turning to the gas engine we will next proceed to make a comparison between a steam plant and a gas plant generating producer gas for use in gas engines, and from such comparison deduce some general results.

As is well-known the gas engine has a very much higher thermal efficiency than the steam engine, which fact, together with the fewer number of auxiliaries required, would naturally lead one to suppose that a greater economy could be secured in the production of power.

The overload rating of the gas engine is different from the steam engine in the ratio of about 15 to 50 per cent. Hence in designing two plants, steam and gas, for equal overload capacities, it is necessary either to use gas engines of 25 to 35 per cent. higher normal rating, with consequent poorer economy at normal load; or add an extra engine and generator sufficient to take care of the extra overload capacity of the steam engine over the gas engine.



The Tantalium Incandescent Lamp.

The higher the cost of coal the greater is the economy of the gas over the steam plant at high-load factors.

It must be remembered that the fuel economy in the case of the steam plants is taken considerably higher than the average and can only be secured by constant and careful attention to all the details around a power plant; in the gas plant the fuel at 50 per cent. load factor is taken at 1.4 lbs. coal per b. h. p. hr., which is somewhat higher than the manufacturers will guarantee. No matter how the fuel costs may vary from those given in these curves, they are relatively of far greater importance when the load factor is high than when it is low.

(Read before Canadian Society of Civil Engineers by E. M. Archibald, B. Sc.)

THE TANTALIUM INCANDESCENT LAMP.

A NEW type of incandescent lamp, having an efficiency much higher than that of the carbon filament, has recently been perfected in Germany. It is the outcome of experiments that have been carried on for several years.

The chemical properties of pure tantalium are very remarkable. When cold the material resists chemical agents strongly, it is not attacked by boiling hydrochloric acid, aqua regia, nitric acid or sulphuric acid, and it is also indifferent to alkaline solutions; it is attacked solely by hydrofluoric acid. Heated in the air it assumes a yellow tint at about 400 C. like steel, and also like steel the tint changes to dark blue when the tantalium is exposed for some time to 500 degrees C., or for a shorter time to 600 degrees C. Thin wires of it burn when ignited with low intensity and without any noticeable flame.

The electrical resistance of the material at indoor temperature is 0.165 ohms for a length of one meter and a section of one square millimeter.

Differing from most of the previous constructions, the central support consists of a short glass rod carrying two supporters into which the arms, bent upward and downward in the shape of an umbrella, are cast. The upper star has 11, the lower 12 arms, each upper arm being in a vertical plane midway between the vertical planes in which two adjacent lower arms lie. Between these 11-12 arms, which are bent into hooks at their ends, the entire length of the filament is drawn zig-zag.

The standard type for 110 volts, 22 cp., and 1.7 watt per cp., has a filament 65 cm. long and 0.05 mm. in diameter. The weight of this filament is 0.022 grams, so that about 45,000 lamps contain together 1 kilo of tantalium.

This shape offers a number of noticeable advantages. In the first instance it is very stable and will stand strong shocks without damage to the lamp. A considerable number of such lamps sent across the sea to try their resistance to the hardships of transport, came back unhurt, although they were packed just like common glow lamps and no special care in any respect was taken in their handling. The lamp burns, of course, in any position, and can, therefore, be held in any kind of fitting. The light is rather white and agreeable. Its effect is particularly steady if the lamps are provided with ground glass globes.

After some use the filament presents a radical change in appearance when viewed with the naked eye. While the fresh filament has a perfectly smooth and cylindrical surface, the latter acquires a peculiarly glistening aspect as the fila-

ment grows old, so that a lamp having served for some time can be readily distinguished from a new lamp. When looked at under the microscope the filament that has burned for a length of time shows a clear tendency toward contraction and formation of drops or beads.

While with all other incandescent lamps the burning through of the filament is tantamount to the economical death of the lamp, it may happen with tantalium lamps that they burn through several times without loss; on the contrary each burning through is followed by an increase, often considerable, of the illuminating value. This peculiar result is due to the fact that in many cases a broken wire comes in contact with its neighbor so that the circuit is again established. A part of the filament is thus cut out of the circuit and the lamp consequently burns more intensely, in which case, of course, only a short span of life is left to it. Yet in more than one lamp under observation the filament broke after a short period of service and then broke repeatedly, but, notwithstanding this, the lamp had a life of more than 1,000 hours. A lamp with a broken filament has been made serviceable again by tapping it to bring the broken piece into contact with its neighbor.

At present the lamp is commercially manufactured (awaiting the erection of a larger building for the production of tantalium) only for 100 to 120 volts, which supplies 22 cp. at 110 volts, or will have a higher or lower illuminating value if worked at correspondingly higher or lower tensions.—Electrical World and Engineer.

ELECTRICAL PROGRESS DURING 1904.

In reviewing progress in electrical matters that took place during the past year, there are several features which are impressive. For some years past, certain branches of the electrical industry have been marked by an almost feverish activity in extension and construction. Some of this work, it is true, was greatly needed, yet on the other hand, a certain amount was more or less speculative. In all branches of the industry, there has been substantial growth and development. One of the noteworthy features of the year has been the increasing demand for electric light and power for small places of business. There were no startling discoveries in electrical science announced during the year, nor have there been any particularly remarkable new applications.

Telegraphy.

By virtue of its seniority, the electric telegraph is man's first consideration. The Morse system still holds its own as the simplest and most satisfactory for all purposes. During the year, two announcements were made of two important telegraphic inventions. One was the announcement of a satisfactory telegraphic amplifier, which while intended for cable work, can also be used as a relay. The other was the printing-telegraph system upon which work has been done for the past five years. This is a page printing system, the operator merely spelling out his message as it were, on a type writer keyboard, the message being reproduced at the other end in page form.

In the field of wireless telegraphy, much skill and energy have been expended in improving and perfecting the various systems. There was little of a sensational nature, as efforts have been extended rather towards developing a thoroughly reliable and practical system.

Telephony.

The steady and rapid increase in the use of the telephone which has taken place during the past ten years, has continued during last year. The Bell Telephone Companies to-day have not far from two million subscribers, while it is estimated that independent companies have two million five hundred thousand. The expansion of the telephone service is not limited to city and surburban services, for an important part is now being played by it in country and even frontier life. Lumber camps are now kept in communication with the main office, and the farmer finds the telephone service of inestimable value in ordering supplies and disposing of his stock.

Electric Light and Power.

Of the other applications of electricity, electric lighting may be considered first. In this branch the past year showed a good increase and it is in the use of electric lights and power that the small user figures most importantly. The incandescent lamp has been standardized for many years and as yet efforts to improve its efficiency by using special kinds of filament have not been altogether successful. The use of the Nernst lamp is increasing for the lighting of large interiors, for which purpose it is admirably adapted.

In arc lighting, the most important event was the announcement of the successful development of the magnetipe lamp, brought out by the General Electric Co. This is a long arc lamp and gives a white light which is well distributed. The Cooper Hewitt Co., mercury vapor lamp has been accepted as a standard illuminant for photographic purposes, and in this use it has given excellent service.

The tendency in central station design shows the effect of the steam turbine. The practice now is to divide the generating equipment into a number of independent units, bringing them together only at the switch-board.

Electric Railways.

In the electric railway field, the record of the year shows that there has been less building and planning for new roads than usual. During the year, several important electric railway events took place. The first of these was the opening of the New York subway, which cost the city of New York $35,000,000, and which has been building for the past five years. Another important event was the testing of the new electric locomotive for the N. Y. C. & H. R. Ry. Co. The test was pronounced a success in every way, and it is thought that this new machine will meet satisfactorily every requirement in handling heavy through trains operated over the electrical division of this road. Many other railway companies are considering the advisability of adopting electric traction for their suburban lines Much progress has been made in the building of an alternating current railway motor. There are now a number of types offered, but the large companies of this country have decided in favor of the series type.

Power Transmission.

High tension electrical transmission is passing out of the stage of pioneer work, and is becoming standardized. Sixty thousand volts seems to have been decided upon as a satisfactory working limit. At Niagara Falls there are two companies on the American side and three on the Canadian side at work on power houses. At other points of Canada, particularly Montreal important work in power transmission is also going on.

Electrochemistry and Electrometallurgy.

This has been a quiet year in these branches, the particular development being towards improving existing methods. Possibly the most significant incident of the year was the report of the Canadian committee appointed to investigate the electrical manufacture of iron and steel.—Electrical Review.

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

HIGH PRACTICAL EFFICIENCY IN A GAS ENGINE.

THIS paper deals with a remarkably eiency of a 200 b.h.p. gas engine. well-made series of tests of effi-

All of the important items which enter into the problem were carefully measured. Even the heating value of the natural gas was carefully determined at various times during the test, and was found to vary from 990 heat units at its best to 905 heat units per cubic foot as its poorest quality.

The indicated power of the engine was arrived at with an indicator and the actual or brake h.p. was determined by means of a Prony brake.

The amount of gas consumed and its heating value was determined also with accuracy for several ranges of power, from about 30 h.p. to the full power of the engine (200 h.p.).

Even where running at 70 brake h.p. the gas consumption for the actual net useful power delivered was only about 21 feet of gas per hour; which represents an efficiency of nearly 16 per cent. of the heat energy in the fuel. This efficiency, as may be seen from the diagram, Fig. 1, advanced rapidly as the power was increased, reaching an efficiency of nearly one-third the full heating value of the gas for the indicated power of the engine, and actually returning nearly 27 per cent. of the heat in the shape of useful work or brake h.p.

On its best showing at full power the engine developed one brake h.p. on about 10 feet of gas. See top line, Fig. 2.

The reader who is interested will find the entire results of the tests represent-

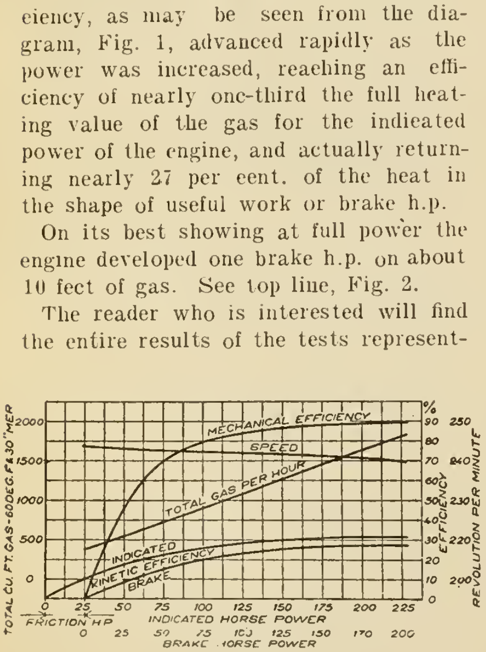


FIG. 1

ed in the diagrams accompanying this article.

An American automobilist has suggested wood alcohol as a substance which will solve the problem, and his laboratory experiments would tend to show that it will fulfil the duties of an anti-freezing mixture admirably.

The laboratory tests were made with a view to ascertaining what degrees of cold various percentages of alcohol and water would resist, and it was found practically impossible to freeze any mix-

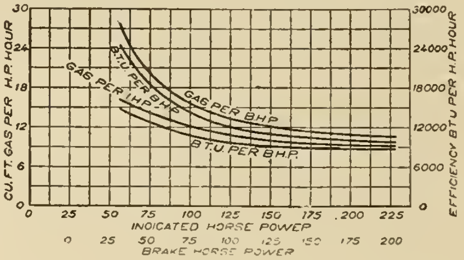


FIG. 2

ture containing forty per cent. of alcohol. The next test was to find what loss by evaporation took place. For this purpose, a water-cooled engine was taken and an eighteen per cent. mixture was used. A little glass was attached to the top of the radiator, so as to form a species of still into which any spirit evaporated could collect. Under normal conditions, no loss was recorded, but in a medium temperature, such as would obtain on a mild Autumnal day, or by running the engine without using a fan for cooling the radiator, a loss was noticed.

A further freezing test was made under natural conditions, and the results obtained are set out below. The figures in the first column are the degrees of temperature (Fahrenheit), and those in the second column are percentages of wood alcohol and water which freeze at corresponding temperatures:

30 deg. Fahr..........	1	per cent. alcohol.
25 deg. Fahr..........	5	" "
20 deg. Fahr..........	8½	" "
15 deg. Fahr..........	12½	" "
10 deg. Fahr..........	16	" "
5 deg. Fahr..........	20	" "
Zero	23½	" "

—Electric Club Journal.

MODERN LABOR SAVING MACHINERY.

TO say that this is the age of machinery is no doubt, to utter a truism, yet few people realize how profoundly the conditions of modern life have been modified by the use of machinery. Regarded from the broadest point of view the substitution of machinery for hand labor means an infinite expansion of the power of production. But the positive value of the service of the engineer to modern civilization is not to be measured by mere productivity, weighty as that consideration must be. The advantages of the use of labor saving machinery extend far beyond the purely industrial plane.

It is the hackneyed complaint of the aesthete, of the blind worshiper of Ruskin, that machinery has turned the worker into a blind, soulless tool. Never was there a more complete fallacy. What do labor-saving appliances mean but the subjugation of inert matter to the intelligence of man? In the long run cheaper means of production must spell larger wage-earning capacity as well as larger capital returns, of which fact a splendid example is furnished by the Carnegie enterprises.

The Carnegie millions were made largely by the use of labor-saving appliances. There is probably no field where labor-saving devices can render more signal service to industry and public work than in the handling of bulky and heavy material. Ore, coke, coal, sand, stones, etc., can be most advantageously handled by machinery.

It may be as well to consider the natural divisions and sub-divisions into which modern labor-saving appliances fall. First of all we have appliances that handle material continuously; that is to say, which receive and deliver it in an uninterrupted stream. These appliances are to be found in factories, mills and workshops, in coal and other mines, and in gas works and power stations. The distance traversed by material under such conditions is comparatively limited.

On the other hand material may be moved over relatively long distances by such appliances as light railways, whether automatic or not or by rope and cable ways. To take appliances for handling material continuously we may divide these under two heads: 1, Appliances for lifting in a vertical direction, or from one level to another, commonly known as elevators; 2, Appli-

ances for moving material in a horizontal direction usually called conveyors.

Essentially elevators, as here to be understood, are endless belts or chains which carry buckets or other receptcles of suitable size and shape for lifting the material to be handled. The position of elevators and the speed at which they run depends upon the material they have to lift. An elevator raising material of low specific gravity may be driven at a much higher speed than one intended to handle material of high specific gravity.

In antithesis to elevators which run in either a vertical direction or move from one level to another we have conveyors which move material in a horizontal direction only. The conveyor has a pedigree of great antiquity.

Screw conveyors can carry all kinds of material in a horizontal plane but they are not without drawbacks. They are relatively large consumers of power and require careful attention to details of construction, such as the bearings.

Another type of conveyor is the push-plate conveyor. This in principle, consists of a fixed open trough formed of sheet iron or steel and angle or chained irons. The material to be conveyed is pushed or dragged along this trough by a series of plates set at right angles to the bottom of the trough. Push-plate convey-

The standard method to-day of conveying grain and other similar materials is by a band conveyor. Endless bands used for heavy and bulky material cannot be run at a greater speed, but the size rather than the specific gravity, determines the speed.

Another appliance for conveying material in a horizontal direction or at a slight incline is the travelng trough conveyor, which consists of an endless trough the sections of which are riveted to the links of suitable chains. The vibrating trough conveyor has within the past few years come into extended use for the handling of such material as coal, cement, ashes, coke, grain, chaff, etc., as well as minerals of all kinds.

The distinct operations of carrying in a vertical and horizontal direction have been combined in the gravity bucket conveyor, which has some affinity to an elevator in so far as it consists of two endless chains or ropes held apart at a fixed distance by bars fitted with small rollers at each end. Combined elevators and conveyors of this description are very useful in coal stores, where delivery has to be effected to overhead bunkers. Such an appliance will perform in one single operation what would otherwise require the use of two conveyors and one vertical or inclined elevator.

There are many other devices for moving materials at a minimum of labor and expense, such as rope ways and aerial cableways, not to mention automatic truckways and self-discharging railway trucks.—Cassier's Magazine.

A REVOLUTIONARY INVENTOR.

MANY remarkable inventions have had their striking romance, but there is none in which the triumph of character is more signal than in the Hoffman rotary engine. The patent offices of the nations have thousands of patents on file, taken out by men who thought they were about to succeed, and even now, at least ten thousand investigators have dropped their work only long enough to learn whether William M. Hoffman's achievement is so great as to make their further research in vain.

The details of his engine, which are now familiar to the scientific and mechanical world, are simple. The engines in use to-day are called reciprocating engines, because the piston is forced in one direction by the introduction of steam into one end of the cylinder and forced back by the introduction of more steam into the other end, and the starting and stopping of motion thus achieved is made to drag a wheel around by a crank attached to the piston. For every revolution of that wheel the piston must start and stop twice. In the Hoffman engine, the cylinder itself revolves. It encloses a steel ellipse traversed by a hollow shaft, into one end of which the steam is introduced, and from the other end of which the exhaust takes place. Steam is admitted by a port in the side of the ellipse, in one-sixth of one revo- truding into the space between the ellipse the cylinder and a segmental blade protruding into the space between the elipse and the cylinder, but so arranged that it can be pushed back into a housing in the cylinder as the cylinder in revolving presses against the surface of the ellipse It has its duplicate blade diametrically opposite in the cylinder. The blade is moved by the expanding steam, and forces the cylinder to revolve until the second blade gets beyond the steam port, and then the pressure against the second blade forces the further revolution, each blade performing its function for half of the revolution.

There is no limit to the speed, except the resistance of the steel of the engine to the centrifugal force generated, so that a forty-eight inch wheel can be spun two thousand times a minute. That means, a train can run four miles a minute, which makes travel at the rate of one hundred miles an hour quite ordinary under these conditions. One could leave New York Saturday night, and wake up in San Francisco Monday morning, go to Philadelphia from New York while breakfasting hastily, cross the Atlantic in two days, and such other marvelous things. It would all be done at fifteen per cent. of the friction, three-fourths of the steam, and far greater saving in first cost and maintenance, than in the present best engines.

It was in the tenth engine that he saw that he must make the cylinder instead of the piston revolve and in the eleventh that he devised the automatic cut-off which regulates the steam admission and keeps the engine under a control more perfect than has been attained in any other motive machine ever built The first successful engine was one of only twenty-eight horse-power, but the latest model and the one which is the wonder of this mechanical period generates three hundred horse-power, and yet is no larger than a pony piano. —Leslie's Monthly.

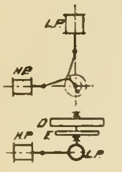
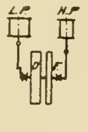
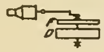
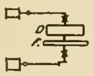
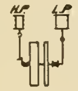
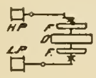
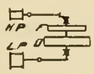
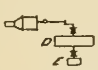
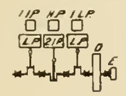
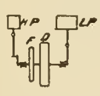
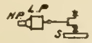
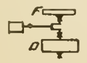
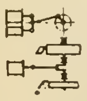
THE LARGEST COAL STORAGE PLANT IN THE WORLD.

THE new plant of the Philadelphia and Reading Coal and Iron Company, being constructed at Abrams, Pa., will have a capacity of about 500,000 tons when completed. Almost 15,000 tons can be placed in the piles daily, and 10,000 tons can be reloaded on cars in a day of ten hours.

Owing to the seasonable demand for anthracite coal the problem of storing it during the dull season in order to meet the demand when it is most active is an important one with the coal mining and hauling companies. In view of the fact that the great bulk of anthracite coal is used for domestic purposes, there is naturally a rush of orders during the late Fall and Winter season, while during the Spring and Summer the demand is comparatively slack. This condition not only taxes the mines beyond their capacity during the time of active demand, but it brings about a state of almost total stagnation at the mines during the dull period. The disadvantage of such an uneven state of affairs is apparent.

The storage system has been found to be most effective, for it permits the continuous operation of the mines with

STEAM ENGINES AT THE ST. LOUIS FAIR 1904.

Number Of	Steam Engine. Builder	Style	Cylinder Diam. High Pressure	Low Pressure	Stroke	Rvs. P.M.	H.P.	Condenser.	Generator. Builder	Curr't.	Volts	K.W.	Notes.
ONE.	Allis-Chalmers Co. Chicago Ill.		44	94	60	75.	5000 norm 8000 max	Arlbergs Jet Condensor with Barometer pipe. Special Engine to drive Dry Air Pumps and Centrifugal Pump for Jet. condenser.	Bullock Electric Mfg Co Cincinnati O	Alternating 25 Cycles	6600	3500	Exiter a 250 K.W. 250 V. "Bullock" Direct connected to "Ideal Engine" made by "Ide and Sons" Springfield. Ill.
FOUR.	Westinghouse Electric and Mfg Co. Pittsburg, Pa.		36	76	54	83.5	4 × 2650 norm.	2 Arlbergs Jet Condenser for Engines in connection with cooling tower and Centrifugal Pump in Boiler House.	2-supplied by the Westinghouse Electric and Mfg Co. 2-supplied by the General Electric Co.	Alternating. 25 Cycles	6000	2000	Exiters 3-Westinghouse Direct Connected generating sets 80 KW 125 Volts.
ONE.	Murray Iron Works, Burlington Iowa.		26	—	48	100	750 1000 with Condensation		Crocker-Wheeler Co., Ampere N.J.	Direct	550	500	Built for a Rolling Mill.
ONE	Harrisburg Foundry and Machine Works, Harrisburg, Pa		15	$40\frac{1}{2}$	26	100	600	Arlbergs Surface Condenser.	same.	Direct.	550	400	
ONE.	Lane & Bodley Co. Cincinnati, O.		20	40	54	85	900		same	Direct	550	600	
TWO	Brown Corliss Engine Co, Corliss Wis		18	36	36	135	2 × 750		same.	Direct	550	2 × 500	
ONE.	Buckey Engine Co., Salem, O.		$26\frac{1}{2}$.	50	48	100	1400	Surface Condenser (Marine Type) made by the Wheeler Condenser Co. New York.	same.	Direct	550	900	Often used in Rolling Mill
ONE.	J. & E. Greenwold Co., Cincinnati, O.		18	36	42	100	600		Fort Wayne Electric Work Fort Wayne Ind.	Direct	550	900	
ONE	Bradley Mfg Co., Pittsburg, Pa		High Press're $13\frac{7}{8}$	Interm Press're $20\frac{1}{2}$; Low Press're $32\frac{1}{4}$	$13\frac{7}{8}$	277	1000	Worthington Surface Condenser - 25 HP Motor for Circulating Pump - Blake Air Pump.	Stauby Electric Mfg Co. Pittsfield Mass.	Alternating. 60 Cycles	2300	600	Exiter a 30 KW 110 Volts "Northern Electric Mfg Co." direct connected to a 50 HP Williams 
ONE.	Elsäss Maschinenbau Gesellsch, Mulhausen i E		600 mm $23\frac{5}{8}$	1000 mm $39\frac{3}{8}$	1300 mm $50\frac{1}{4}$	94	1000	Surface Condenser attached to Engine with special Motor for Circulating Pump Air Pump Connected to Crosshead	Societé Anonyme de Constructions mecaniques. Belfort	Alternating 50 Cycles	2300	900	Exiter E 200 amp 110-V mounted on Generator Shaft.
ONE.	Soc an des etablissements De launey Belleville St. Denis (Seine)		High Pr. 300 mm $11\frac{7}{8}$; 1. Inter Pr 2 × 300 mm $2 \times 11\frac{7}{8}$	2 Inter Pr 680 mm $26\frac{3}{4}$; Low Pr 2 × 680 mm $2 \times 26\frac{3}{4}$	250 mm $9\frac{7}{8}$	355	1500	Surface Condenser.	Soc L'Eclairage electrique, Paris	Alternating 50 Cycles	2400	900	Exiter "E" 39 KW mounted on Generator Shaft
ONE	Hooven. Owens and Rentschler Co, Hamilton, O.		34	68	54	85	2250	Surface Condenser made by the Blake & Smith-Vaile Co., Dayton O.	National Electric Co. Milwaukee Wis.	Alternating 25 Cycles	6600	1500	Exiter 45 KW 205 amp Generator driven by a Motor 60 HP. 220 amp 220 Volts 800 Rvs
ONE	Buffalo Forge Co, Buffalo. N.Y.		13	$23\frac{1}{2}$	14	225	175		No Generator				Fly Wheel Overhonging
ONE.	Skinner Engine Co Erie Pa		18	—	18	212	200	No Condenser	Warren Electric Mfg Co. Sandusky O.	One Phase Alternating 60 Cycles	2300	150	Exiter 10 KW. Motor Generator.
ONE.	American Engine Co, Bound Brook N.J.		14	$23\frac{1}{2}$	16	235	225		American Engine Co., Bound Brook N.J.	Direct	110	125	

HP- High Pressure.
L.P.- Low Pressure.
1.IP- First Intermediate Pressure
2.IP- Second.
F.- Fly Wheel
D.- Generator
E- Exiter

a decreased force from one end of the year to the other. When trade is slack the coal simply goes to the piles, and when the flood of orders comes the piles are simply drawn from to meet the exigencies of the occasion.

In the operation of the system a chain conveyor, supported by a sheer truss, constituting a trimming machine, is employed to stock out the coal, and a pivoted or swinging ground conveyor, consisting of a flighted chain suitably mounted on a steel frame and actuated by power in all its movements, is employed for reloading the stocked coal into cars. The sheer truss of each trimming machine is arranged to span the pile to be formed, and is fixed at or about the natural angle of repose of the coal.

As usually arranged for open air storage on leveled ground, two trimming machines and one reloading machine located between them constitute a group, and the storage plant consists of the required number of these groups, which may be either of the same or of varied capacities. In the operation of the plant the coal received from cars in a hopper located beneath the receiving track is fed through a chute to the conveyor of the trimming machine, which delivers it upon the ground, or at the apex of the pile as it forms. The bottom of this conveyor is a steel ribbon, usually 12 inches wide, which is wound upon a drum located at the foot of the truss and arranged to be drawn out in grooves fixed in the conveyor trough so that its end, which is the only discharge point for the coal from the trimming machine, shall always be at the constantly rising aod receding apex of the pile. With the trimmer building the pile up from the base in such a manner, the drop of the coal will not exceed 12 inches at any time throughout the entire operation. The breakage is thus reduced to the minimum. The reloading machine is composed of a horizontal and an inclined portion, both working together so as to render the carrying of the coal continuous from any point on the horizontal portion to the upper end of the inclined portion. Here a pocket is provided into which the coal flows, and from which it is discharged over shaking screens, and delivered into the cars. The horizontal portion of the reloader is pivoted at the foot of the incline, and provided with wheels, which run on circular tracks between and under the two heaps of the groups. The power mechanism of this apparatus is so arranged that one man on the operating platform handles the reloader with ease, taking coal automatically from the base of either of the two piles as may be required.

The Trend of Machine Shop Practice

WHILE the past few years have seen an almost entire revolution in industrial conditions, and the trend of modern practice in tne direction of increased output and efficiency in all lines; nowhere has the development been more striking, or the improvement more marked, than in the machine shop. Although smaller shops all over the country still continue to some extent their old methods, there is a great contract between them and the larger installations of recent date. Yesterday the machine shop was cramped, very often dark, and without system, which was not conducive to best results. To-day the place is commodious, well-lighted and systematic, exercising a cheering influence on the machinist, and therefore rendering him capable of doing more and better work for his employer. Then, things were done by rule of thumb. Now everything is reduced to exact mathematical calculations. Tons of material are now handled with less difficulty than was necessary for pounds before.

In accomplishing this, overhead cranes and indoor tracks are leading factors. It is safe to say that without travelling cranes the great shops in existence to-day would be impossible.

The most striking feature of all, however, is the method of running the machines. Formerly, all machines were run by power developed by one or more large units, connected by long lengths of shafting throughout the entire shop. This meant the running of the engine or engines all the time, whether the machines were under load or not, and consequently a large amount of waste power. With the shaftings not properly alligned a large amount of power is lost. In an extreme case by means of an actual test, it was found that 80 per cent. of the total power given out by the engine was taken up by the shafting. The present method is to drive the machines by motors having a separate motor for each of the larger machines, and having several of the smaller ones connected to a short shaft, and run by the same means. Thus the motors are run only when the machine is doing work, and no power whatever consumed when it is idle. The electric drive affords small sub-divices of power, and we have a complete solution of using power only when something is to be done with it. One of the greatest advantages of this is the flexibility of installation which it affords.

No sooner had the electric motor found its way into the machine shop, than there appeared men who insisted that every machine should have a separate drive. Of course this is an extreme view. The plan which meets with the approval of the best machine shop engineers is to employ individual drives for tools which require motors of 5 h. p. and upwards, and smaller tools requiring less h. p., to be arranged in groups to give a fair load to motors of 5 h.p. or upwards.

Portable tools are another innovation in a machine shop and to them the above rule of power does not apply.. Through the agency of compressed air portable tools were used to some extent before the advent of the electric drive: but it is now possible to employ portable tools to an extent never thought of before. With the manufacture of larger and larger machines the difficulty of getting the machine parts into proper place for working them increased in greater ratio, and the time lost in making adjustments was great. Portable machine tools have come to the rescue and the machine is taken to the work instead of the work being taken to the machine. This has made practicable the making of large machines, such as generators, whose manufacture under other circumstances would be commercially impossible.

> **Success is attained not by not making mistakes, but by not making the same mistakes twice.**

We have in Canada one of the largest locomotive works and the best car shops in the world, both of recent construction and in the machine shops of these, traveling cranes, electric drives, and portable tools are striking features.

High speed tool steel, the introduction of which is only just commencing, is another feature of the modern shop, and one which promises a still further improvement in manufacturing. The greatest effect of high speed steel will be towards a complete change in the design of machines and machine tools. Take an engine lathe for instance. The power must be increased, the saddle and side rests must be stiffened, and the feed gear driven. Where the usual practice of 1-32 inch and 1-16 inch feeds now prevails, there would be 1-8 and 3-16 inch feeds. Its introduction will make possible the manufacture of machines from 25 to 33 per cent. of their present cost. Before this has been fully accomplished new designs must be worked out and found to stand severe tests before they are put on the market.

Grinding tools have been wonderfully improved, and rapid strides have been made in the art of grinding during the past few years. Grinding machines made in innumerable types handle efficiently the roughest and the finest work. While the emery wheel and the grindstone have been used for years, the value of the grinding machine for finishing is of comparatively recent adoption.

The use of jigs, templets, false tables, etc., are all being given proper consideration. Machines costing many thousands of dollars are often left lying idle over half the time, while the work is being set up. In many instances this could be done on false tables and the output of the machine greatly increased, with a consequent reduction in the cost of machinery.

The proper routing of material is another matter that has been given serious attention, so that work may go through the shop with the least amount of handling and transferring, as this is one of the first essentials in economic production.

The present method is towards standardization and this is especially true of machine shop details, which heretofore have been taken care of according to the whims of numerous designers.

Professor Unwin has said, "In all producing industries there are operations requiring greater and operations requiring less intelligent, operations requiring greater manual skill and others requiring little manual skill. The subdivision of labor, which has arisen in modern industries, has for its object to economize the intelligence and skill and other special faculties of the workman. The factory should be so arranged that manufacture is carried on by the most advantageous number of processes, each worker doing what he is best fitted to do, and the number of workers in each class being proportioned to the requirement of the process allotted to it."

Electrical Development at Canadian Niagara

NIAGARA—"Thunderer of the Waters"—whose fame has spread throughout the entire civilized world, and whose name is not only synonymous with power, but associated with history, literature, art and religion on this continent, is to-day being harnessed for the use of man to a degree possible only by the high state attained in engineering practice within the present generation. The great development now under way is towards the application to industrial progress of some of the enormous power on the Canadian side, to which serious consideration has scarcely been given until within the past few years. Even to the visitor who comes to view the scenic grandeur of the place the wonderful power possibilities are at once apparent, but it is only when standing at the foot of the fall or on descending into one of the large wheel pits, recently constructed, that the proper realization of this is experienced. Nine-tenths of the flow of the Niagara River passes over the Canadian falls, hence the available power is nine times that of the American side and when the four hundred and fifteen thousand horse-power soon to be delivered from the power houses of the three companies at work is available, this country will have a greater hydro-electric development than any other in the world.

A striking feature of the work in progress is the enormous scale on which plans have been made and are being carried out. It is not within the scope of a short article to dwell upon the engineering difficulties and triumphs of the case, suffice to mention that problems were encountered and overcome that never before loomed up in front of the engineer in the practice of his profession.

Three companies have acquired rights and charters in connection with the utilization of the water on the Canadian side, namely, the Canadian Niagara Power Co., which proposes to develop one hundred and fifteen thousand horse-power; the Ontario Niagara Power Co., to develop one hundred and eighty thousand horse-power: and the Electrical Development Co., of Ontario, to deliver one hundred and twenty-five thousand horse-power. In order to give a proper idea of what is being accomplished it is necessary to describe separately what each has done and proposes doing. At present the only company in a position to deliver power is the Canadian Niagara Power Co., who started the first two ten thousand horse-power units in the new station in Victoria Park on the morning of January 2nd.

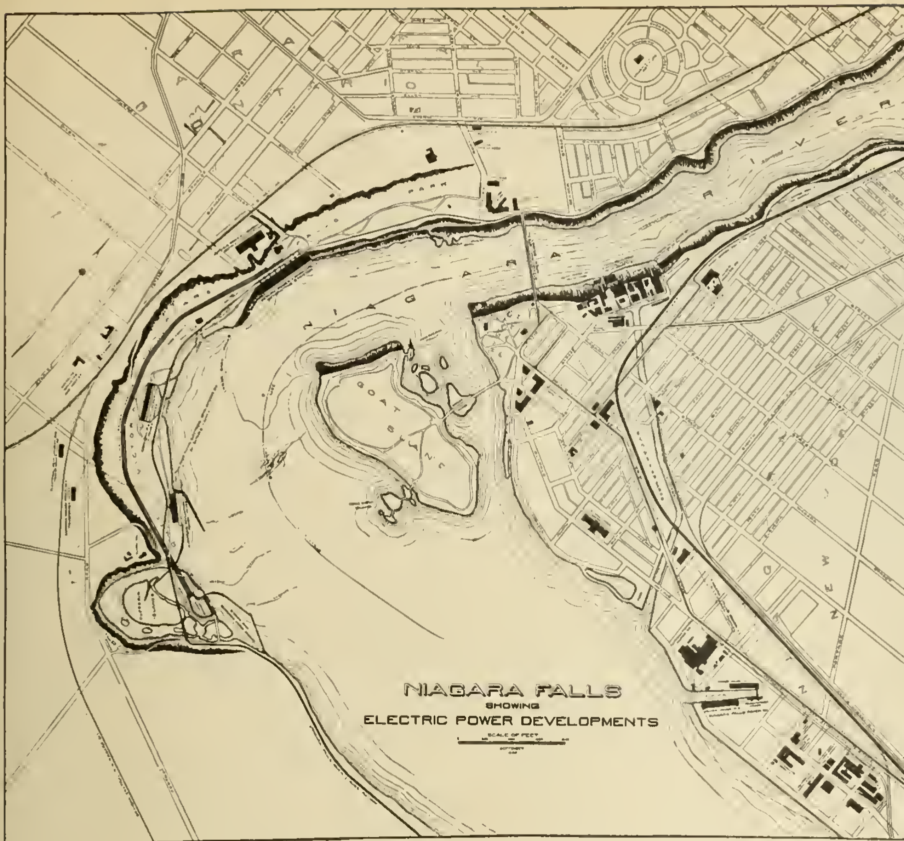
For the assurance of those who imagine that the utilization of this large amount of water is going to make a material difference to the falls, it might be added that there will still be twelve to fourteen feet depth of water passing over the Canadian Falls at the centre, and that only about seventy-eight thousand out of a total of two hundred and twenty-three thousand cubic feet per second will be diverted, leaving two-thirds of the present volume to perpetuate the scenic effects of the horseshoe cataract.

The effect of this enormous development of power on the Canadian side in connection with the manufacturing industries of Ontario can hardly be estimated. It will mean that the coal that is now being mined in a foreign country, taken from the bowels of the earth and handled by grimy processes before being used, will be superseded by the silent current, that traverses the slender wires with the speed of light and is ready for instant operation without any mechanical manipulation whatever. It will mean that large factories will spring up into existence, employing large numbers of men and creating a hive of manufacturing industry in Western Ontario that in a few years will compare favorably with the manufacturing output of the New England States.

Power House—The Electrical Development Co. of Ontario, Limited.

THE ELECTRICAL DEVELOPMENT COMPANY.

The company was incorporated on the 18th of February, 1904, under the name of the Electrical Development Co., of Ontario, Limited, with a capital stock of $6,000,000, and on the 2nd of April of the same year work was begun on construction. The directors of the company are: President, Col. H. M. Pellatt; vice-president, F. Nicholls: 2nd vice-president, William Mackenzie; also Hon. Geo. A. Cox and James Ross. The other officers of the company are: H. G. Nicholls, B.Sc., secretary; D. H. McDougall, treasurer. The consulting engineers are: F. S. Pearson, Dr.Sc., and Hugh L. Cooper; resident engineer, Beverley R. Value; 1st assistant engineer, Julian Thornley. The plant is located on the Canadian side of the Nia-



Map Showing Power Development at Niagara Falls.

gara River, near Tempest Point, about one-half mile above the Horseshoe Falls, and at the foot of the rapids above the falls.

Scheme of Development.

The scheme of development consists of a system of head works for taking care of the ice and controlling the flow of water to the penstocks, a wheel pit and a power house, or generating station over it; a tail-race tunnel and a transformer station where the power voltage for transmissio nto Toronto will be acquired. A novel feature in connection with the construction o. the works of this company, is the fact that they are all practically constructed on what was previously the river bed, so that no encroachment has been made on park territory but the room required has been wrested from the most turbulent part of the upper rapids at Tempest Point. It was necessary in accomplishing this to unwater about twelve acres of the river, the doing of which called for much engineering skill. When this was accomplished after much difficulty a concrete gathering dam, with granite copping, extending up-stream from the lower end of the wheel pit at an angle of thirty degrees, was built to conduct the water to the gates. This dam acts as a spill-way for its entire length, thus enabling the surface ice to escape before reaching the submerged arches. The work in connection with the excavation of the main tail-race tunnel was attended with considerable excitement and risk. The main tunnel, which is the largest in the world, is about 2,000 feet in length by about 33 feet in diameter in the rough, that is before being lined with cement, concrete and hard burned brick. It is constructed 158 feet below the bed of the river, commencing at the end of the wheel pit and discharging behind the falling waters of the Horseshoe Fall about 700 feet from the shore. Another feature of this tunnel is the fact that instead of starting with the wheel pit it starts with two branches, one on either side, and these join at a point 165 feet beyond the end of the wheel pit.

Wheel Pit.

The pit itself is almost completed and is 416 feet long, 67 feet wide and 150 feet deep, and will be lined with brick masonry. At the bottom will be placed eleven turbines with a capacity of 12,500 horse-power each. These are now being constructed and when installed will be the largest turbines in existence. They will have two runners

Route of Toronto Niagara Power Co.'s Transmission Line.

Outer Ice Rack and Canal Bridge—Canadian Niagara Power Co.

right and left and will be connected with the generators on the main floor of the power house by means of hollow steel shafting, 1..0 feet in length with solid couplings. To each turbine the water will be conducted by a penstock 10 feet 6 inches in diameter and the tail water will be carried off through draught tubes of 9 feet diameter. In addition to the eleven turbines there will be two 125-volt exciters of 300 kilowatt capacity, driven by water turbines, and three exciters driven by induction motors.

Power Generation.

The generating station or power house will be placed immediately over the wheel pit. Its style of architecture, as will be seen from the illustration, is of Italian renaissance and its size 500 feet long, 104 feet in width and 40 feet high. It is situated on the bank of the river at a somewhat higher elevation than the main park driveway, and to overcome the difference in elevation broad terraces and wide flights of steps will be constructed, adding materially to the aesthetic appearance of the landscape at this point.

The power will be generated by eleven 8,000 kilowatts generators of the vertical inside revolving field type with twelve polls, 250 revolutions per minute, and delivering a three phase alternating current of 25 cycles 12,000 volts.

For the purpose of providing manufacturing sites for industries which may desire to locate near Niagara Falls in order to use the power of this company, some 530 acres of land have been purchased, fronting on the Chippewa River about two miles from Niagara Falls.

The power generated will be delivered by underground cables to the step-up terminal station of the Toronto and Niagara Power Co. which has been organized to distribute the output of the Electrical Development Co.'s power house. This terminal station is located on the top of the Niagara embankment above the park, about 1,500 feet from the power house. The current will be delivered at 12,000 volts, where it will be raised by the step-up transformers to 60,000 volts for transmission to a similar transformer station building at Toronto, where it will be reduced by step-down transformers to the commercial voltage required. Although the first transmission line is being built to reach Toronto, the company having secured contracts for a large block of power from the Toronto Electric Light Co. and the Toronto Railway Co., it is intended later on to construct transmission lines to such other points in Ontario within a distance of say 150 miles from the generating station, where a market can be found that will warrant the cost of constructing transmission lines. The Niagara-Toronto line is being built within a private right-of-way and steel towers are used instead of wooden poles for supporting the copper cables.

THE ONTARIO POWER CO.

There is a distinct difference between the proposed plan of development by the Ontario Power Co. and that of the others in operation. Instead of taking the water from the river at the power house, conducting it through penstocks to the turbines in the wheel pit below, and discharging it into the lower river by means of a tunnel, they propose gathering the water required at their head works at the upper end of the park, conduct it through a steel pipe of over 6,000 feet in length to a point in the cliff below the Falls, thence by penstocks in tunnels through the cliff to the power house in the gorge. The head works are located in the smooth water of the upper river above the first line of rapids opposite the Dufferin Islands and the water will be conducted by three 18 feet main conduits through the park to the point on the cliff below the Falls where the power house is situated and which latter is now in course of construction. The grants from the Dominion Government, under which this company is making its development were secured in 1887, but the work has not been prosecuted until very recently.

Plans in Operation.

The headworks consist of an intake proper, and outer forebay, screens, an inner forebay and control gates.

The intake, 618 feet long, consists of concrete piers, supporting a continuous,

Power-House and Forebay—Canadian Niagara Power Co.

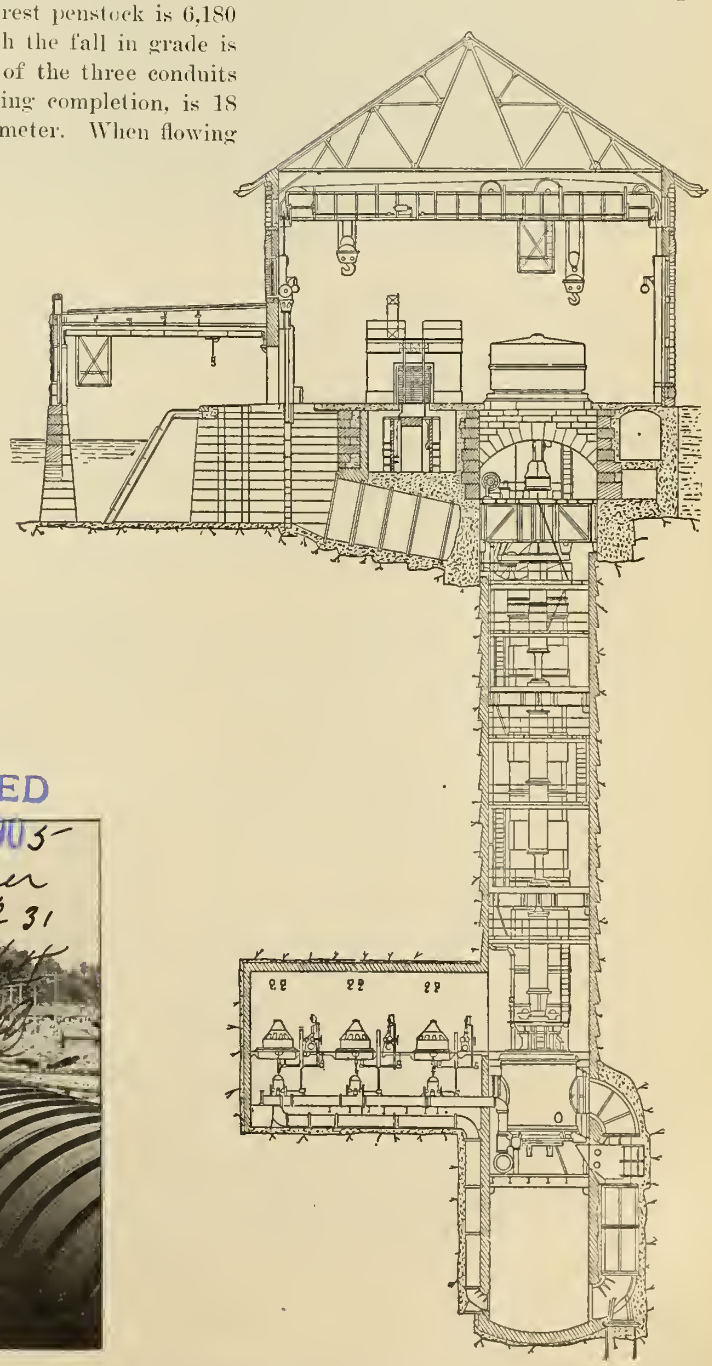
reinforced, concrete curtain wall. More than double the quantity of water to be utilized at the water wheels is intercepted by the up-stream face of the intake, and much is there deflected to form a cross current which will carry away ice. This is brought about by a curtain wall construction and the placing of the structure at an obtuse angle to the natural direction of the current in the river. The outer forebay, which contains an area of eight acres, is bounded by an artificial island and the original river bank on the one side, and by a long concrete gathering wall on the other. A supply of water is provided for the restoration of the Dufferin Island Channel, which is controlled by sluices on either side of the island mentioned. Except during extremely low stages of water in the river, the outer wall of the forebay will be constantly submerged, water spilling freely over it into the river as over a weir, carrying floating ice and debris with it. A section of this wall, 100 feet in length, adjacent to the screen house, is constructed with the top depressed below the crest of the main portion. When water at the intake is at extreme low level, there is thus an additional discharge area of approximately 300 square feet cross section over the depressed section.

The screens are in the form of a steel grillage, set on inclined guides in concrete masonry, and are removable by means of a crane. The apparatus is covered by an artistic stone building, the roof of which forms a broad promenade, commanding an exceptionally fine view of the rapids. The inner forebay, with an area of two acres, extends from the screen house to the gate house. The landward wall and the river wall are formed partly by the rock face after excavation had been made in the river bed, and partly of concrete. On the land side, excavated material has been dumped and graded to bring the general surface of the islands in this vicinity up to the same level as the top of the concrete wall, at elevation 560. The original Dufferin Islands have been increased in area, and several entirely new islands of considerable size have been made from the excavated rock, approximately 150,000 cubic yards, taken from the bed of the river in deepening the two forebays.

Starting from the gate house, the main conduits, three in number, follow the river bank through the park to the top of the cliff opposite Goat Island. The distance of the nearest penstock is 6,180 feet in which length the fall in grade is 28 feet. The first of the three conduits which is now nearing completion, is 18 feet in interior diameter. When flowing at full capacity it will pass about 3,900 cubic feet of water per second. From the underside of the first main conduit, six penstocks, each nine feet in diameter, drop in pairs through vertical shafts and out through horizontal tunnels in the solid rock of the cliff to the power house. Each penstock supplies water for a 10,000 horse-power unit.

The building is 76 feet wide and 65 feet high, and for the full capacity will be about 1,000 feet in length. The roof is flat, and the general style of architecture is massive and somewhat after the Egyptian order. The main generators and their turbines, directly connected, are the only machines placed on the floor of the station. On a raised gal-

Main Conduit—Ontario Power Co.



Cross Section Canadian Niagara Power House and Wheel Pit.

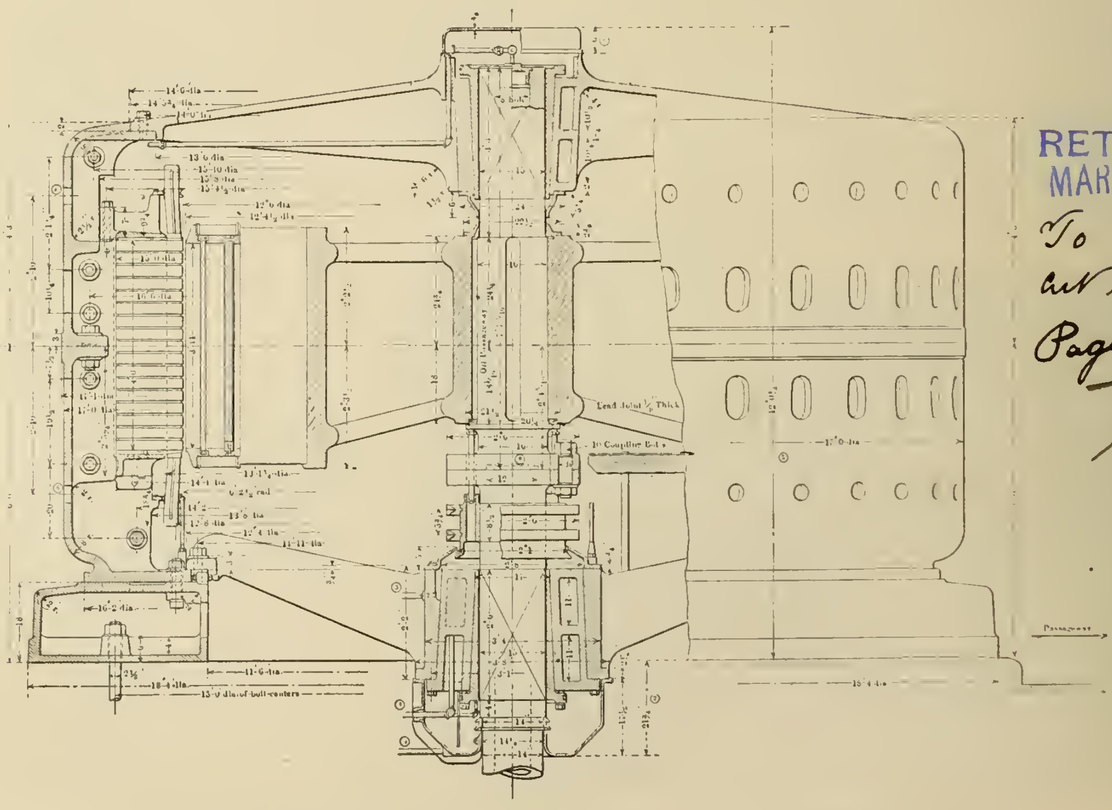
Main Thrust Bearing—Canadian Niagara Power Co.

lery, 11 feet above the main floor, and extending along the rear wall of the station, are located the excited turbines, the direct connected exciting dynamos, and the governors that regulate the speed of the turbines. At a distance of 550 feet back from the generating station and on the bluff at an elevation of 250 feet above it, is situated the control, transforming and distributing station. This distant control removes from the generating station the possible dangers incident to the operation of high voltage switches for generation, as well as for transformers, and also concentrates the management of both in a single operating room.

CANADIAN NIAGARA POWER CO.

As far as present development is concerned, the greatest interest is attached to the plant of the Canadian Niagara Power Co., as they are the only company with machinery installed and in a position to-day to deliver power. In justice to this company, it might be mentioned that the illustrations of its equipment are taken under disadvantageous circumstances, and are in strong contrast to the proposed finished appearance of the place, which will be completed along the lines adopted by the Niagara Power Co., whose plant is a thing of beauty, as well as an engineering achievement.

This company was incorporated by an Act of the Legislature of the Province of Ontario in the year 1892. It is an allied company of the Niagara Falls Power Co., which has built the two power houses on the American side. The officers of the company are: President, W. H. Beatty; vice-president and treasurer, W. B. Rankine; second vice-president and secretary and solicitor, A. Monro Grier, K.C.; third vice-president, Geo. W. Davenport; assistant treasurer, W. Paxton Little; chief mechanical engineer, Dr. Coleman Sellers; resident engineer, A. H. Van Cleve; electrical engineer, H. W. Buck; assistant engineer, G. A. McCarthy, C. C. Egbert and G. E. Brown.



Section and Elevation—Canadian Niagara Power Co.—15,000 H.P. Generator.

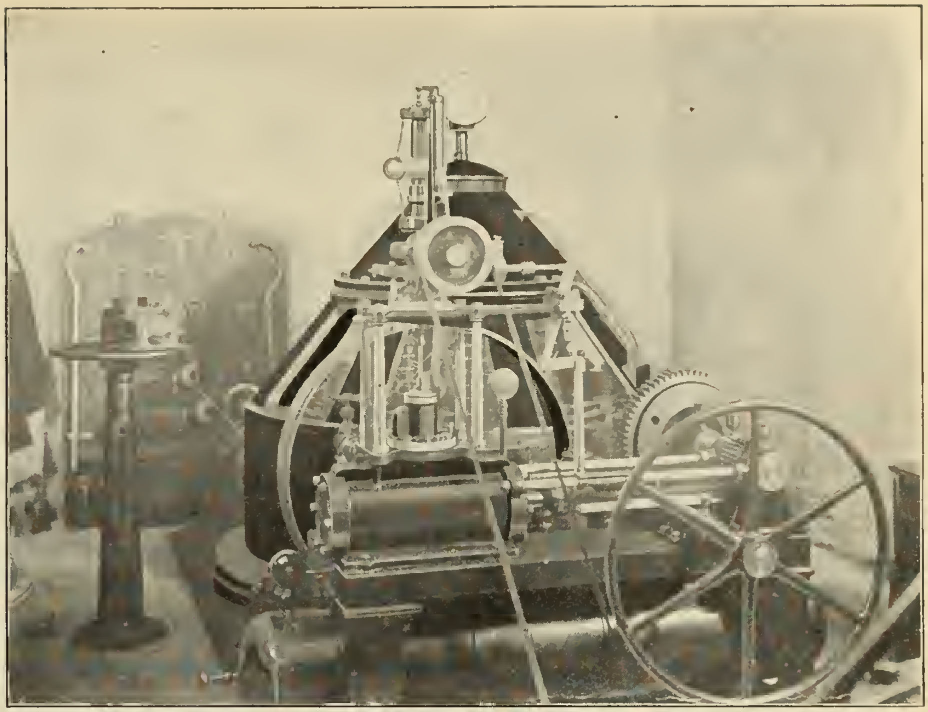
One of the most interesting features in connection with Niagara development was the construction of the coffer dam by this company in the swiftly-flowing waters. The water flows past their intake at the rate of 11 feet a second, rendering the undertaking difficult and hazardous, but it was accomplished successfully.

Tunnel.

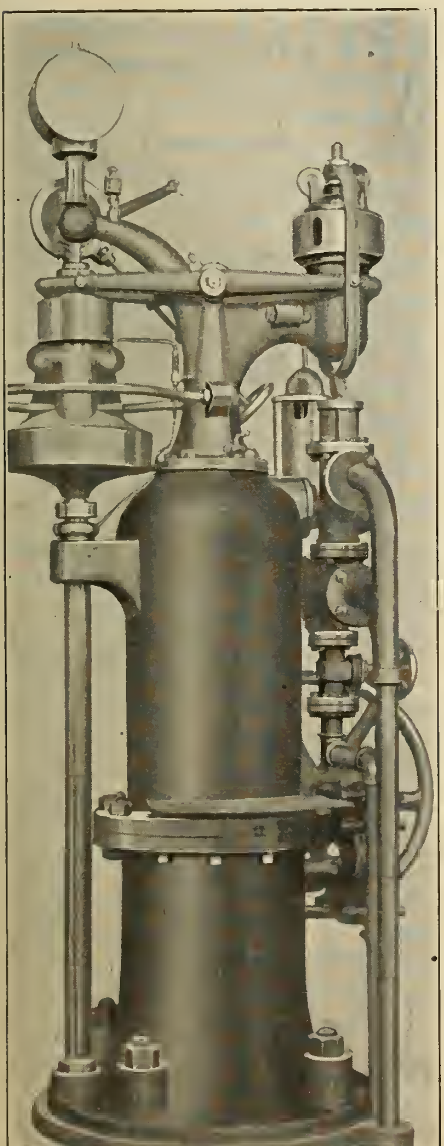
The tunnel tailrace which leads the water to the lower river after it has left the turbines, is 2,200 feet long and of a horseshoe form, 25 feet high and 10 feet wide, being lined with 17 inches of concrete with vitrified brick facing.

Canal.

The head canal, built entirely of massive limestone masonry, has a clear waterway 15 feet deep and 250 feet wide, and is crossed by a five-span stone arch bridge which carries the tracks of the Niagara Falls Park and River Railway, a carriage way and sidewalk. This canal widens into a forebay 600 feet wide, extending the whole length of the powerhouse.



Exciter Governor in Operation—Canadian Niagara Power Co.



Governor for 10,000 H.P. Unit in Operation—Canadian Niagara Power Co.

Ice Protection.

Protection from ice is afforded by (a) an outer ice rack along the river face; (b) a line of submerged arches forming outer wall of forebay room; (c) a fine ice rack extending the whole length of power house, inside the forebay room and immediately outside the penstock mouthpieces; (d) overflow weir which can be used in combination with floating booms to draw floating materials back into river again by means of a sluiceway channel.

Wheel Pit.

The wheelpit is 165 feet deep, 18 feet wide inside of brick lining, and 570 feet long. The sides were channelled in 6-foot cuts. This gave smooth sides to the excavation and prevented detached portions of rock falling on the men working below. Some distance below the surface a water-bearing seam was encountered and a brick ring was built around wheelpit at this seam, all surface water led into it, and a large portion of the pumping done from this level.

Five chambers for auxiliary machinery were excavated in east side of wheelpit as the work progressed.

The wheelpit is lined with hard-burned brick. The course next the rock is composed of hollow brick, and ample weepers emptying into the tail water are provided.

Installation.

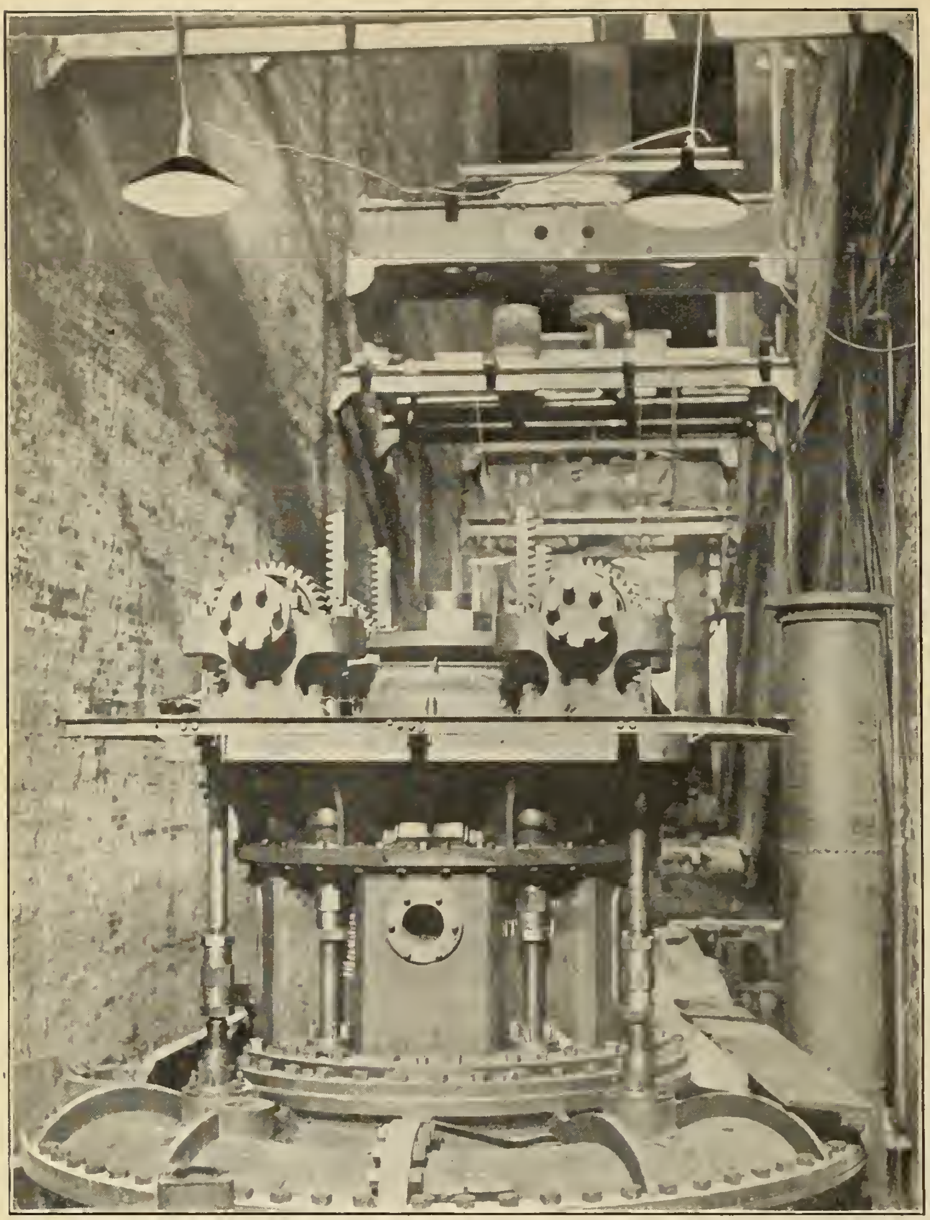
Illustrations are shown of some of the machinery installed, but they fail to do justice to the work accomplished. Since the photograph of the power house was taken, the latter has been completed and ready to accommodate five of the eleven generators to be brought into service. Two of these are now running.

The turbines, each of a capacity of 12,500 horse-power, were designed by Messrs. Escher, Wyss & Co., of Zurich, Switzerland, and are of the twin Francis vertical type, inward discharged, two draft tubes to each unit discharging into the open tailrace below. Three of these units were manufactured and are being installed by this firm, and two units on the same design are about to be installed by I. P. Morris Co., Philadelphia, Pa. The generators are the largest of their kind yet to be built and have a capacity of 10,000 h.p. each. They occupy little more space than 5,000 h.p. units, and cost considerably less per horse-power. They are of the vertical type, as may be seen from the illustration, with revolving fields, and wound for three-phase, 25-cycle current, 11,000 volts, to run at 250 revolutions per minute.

The auxiliary machinery, consisting of exciter turbines, water pumps, oil pumps and oil tanks, are located in the chambers built into the side of the wheelpit 100 feet beneath the surface. This machinery is being operated by an independent water surface drawn from the canal above.

Distribution.

A transformer house, situated south and, outside of Queen Victoria Park, equipped with water-cooled transformers, has been constructed. For long-distance



Installing No. 2 Turbine—Canadian Niagara Power Co.

transmission step-up transformers will be used to raise the voltage to 22,000, 40,000 or 60,000 volts, depending upon the distance of transmission. The power is being distributed by means of No. 000 B & S triple cable, lead covered, cables laid in ducts underground. Underground conduits from the power house to Upper Arch Bridge have a capacity of 75,000 h.p., and from the power house to the transformer station, a capacity of 50,000 h.p.

The plant is now in operation, and its output will be used for Canadian industries in the Province of Ontario within transmission distance of the power house or for United States consumers, as the demand requires.

In the construction of these works, every effort has been made to build for the future. Stone, brick and cast iron have been chiefly relied on and, where used, steelwork has been designed so as to be accessible for inspection, removal and painting. The power house and transformer station are practically fireproof, the roof tiles being laid directly on the steel roof angles.

In the design, all the experience gained in the construction and operation of the plants of The Niagara Falls Power Company has been made use of, and it is believed that the works described represent the best hydraulic, mechanical and electrical knowledge available to date, and that the plant is the best of its type yet constructed.

COKE FOR FUEL.

The fuel question is one that is before the minds of manufacturers at all times. Recent statistics show that coke is coming more and more into use for heating as well as manufacturing purposes, points in its favor being freedom from smoke and cinders, its cleanliness, good heating qualities, ease of handling and lessened cost.

STAMP CANCELLING MACHINE.

A mechanic at Christiania, Norway, has invented a machine, which in an easy, practical and what is most important, in a quick manner, solves the difficult problem, which inventors for years have been engaged in constructing, viz., to find a way of stamping letters, which satisfies the modern wants. This machine, run by electricity, stamps from 500 to 800 letters a minute, has met with the greatest appreciation among postal authorities both at home and abroad. Also the postmaster general of Germany, who recently called at Christiania post office to see the machine in work, expressed himself, very favorably about it. The machine has been patented and orders are commencing to come in.

THE SINGLE-PHASE MOTOR FOR TRACTION.

Within the past two years the single phase motor has come in for a large share of attention on the part of those interested in electric traction as well as those concerned with motor development. Electricity has replaced steam largely on suburban and interurban roads of short lengths, and the fullest possibilities along that line are far from being reached. Little has as yet been done with electricity on trunk lines, but in this connection there is everything to expect. Hitherto the cost to deliver direct current at low voltage for any considerable distance has been enormous on account of the large amount of copper required. And it is in the development of the alternating current motors operating at high tension that a revolution is to be looked for. On the continent three-phase motors have been operating successfully on electric roads, and in America the brightest minds in electrical engineering have been grappling with the subject.

A railway is now in operation in New York State using single-phase motors, the complete success of which seems assured. What this means to Canadian development is yet to be seen, but it is safe to prophecy that before many years trunk lines, run by electricity, will be in successful operation.

A reader of Machinery asks for the address of a firm named Jackson & Bywater. If any of our readers can oblige us with same we shall be glad to convey the information to the reader in question.

CANADIAN

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THE MACHINERY OUTLOOK IN CANADA.

WITHIN the very recent past some of our Cabinet Ministers insisted that Canada's one destiny was along the line of agriculture, that she was destined to become the granary of the Empire, with proper attention, and to gain that end all other interests must be subservient. Under such a policy other branches of development were to be given a secondary place, to have little encouragement and to get along as best they could. The wisdom of a broader view and the encouragement of manufacture has since been well exemplified. In the same way that this country has become great in agriculture by the development of natural resources so will she become great and mighty in manufacture, and were the latter the greatest calamity that could befall her people there would be no escape. It is as certain of realization as the fact that conditions are changing, is apparent.

We are not on the eve of a great industrial revolution in Canada; we are in the very midst of it, and that without anticipation on the part of some, and with the many, no realization of the fact whatever. While hardly sound asleep Canada has been in a state of lethargy and that for several reasons. Agriculture has long held the foremost place to the exclusion of other fields. The country's immensity of extent has been and is yet out of all keeping with the number of population. Erroneous ideas abroad regarding climate and natural conditions have been detrimental both to influx of population and the availability of capital. Lastly and by no means least, Canadians themselves have not been alive to the fact that this country possesses the most favorable conditions in the world for extensive manufacture.

The extent to which this is being realized by our neighbors is shown in the manner in which branch concerns of established manufacturing companies in the States are being started and the readiness with which Americans are investing their capital here. Many of them are taking advantage of the chance for expansion by getting a foothold and thus gaining advantages over those not in a position to do likewise. Their capital is pouring into the country exploiting enterprises the possession of which Canadians have been all too slow to recognize. This capital is developing coal mines in the Maritime Provinces and British Columbia; asbestos in Quebec; mica, nickel, iron and copper in Ontario; reducing aluminum; building iron and steel plants and getting the bounty the Government pays; erecting car shops that already have contracts five years ahead; developing Niagara and other water powers, in every instance of which the machinery acquirements are an important item.

Last Summer, when the British engineers and captains of industry were here, what impressed them most besides the large extent of country were the abundant resources giving unequalled conditions towards industrial expansion. The effect of the knowledge gained at this time is already being felt in turning the attention of British capitalists in this direction and showing the British machinery manufacturer the opening of which they had no conception, and which, as yet, in many cases they little realize.

In Ontario when present undertakings are completed at Niagara half a million horse-power will be ready for use and at reasonable prices, for factory, mill and manufacturing industries, enough to supply 50 cities within a radius of 150 miles with 10,000 horse-power each for industrial needs and create a hive of industry operated by cheap power that would soon become a strong factor in the world's output. Within a radius of 45 miles about Ottawa there is over one million horse-power available in water falls, more than enough to run every mill and factory in North America and at present 97 per cent. of it is going to waste. In Quebec, the Maritime Provinces and British Columbia the same is true, unlimited water power yet untouched, but which is bound to be brought into use within the next quarter of a century. Even in the face of this a large part of the machinery required in Canada for some years must come from the United States and Europe.

The railways are pushing their lines in all directions to new districts in the north, and along these towns have been established in places that as recently as three years ago were mere wildernesses, and for the mills and factories of these their first cry is machinery. The building of the Grand Trunk Pacific will involve an outlay of $150,000,000; and this represents the mere building

of the road, without taking into consideration the requirements for the towns and villages to come into existence along its route or the placing of the rolling stock on the road.

During the coming years of this industrial awakening, in every quarter, machinery of a high order of material and workmanship will be called for. As the trunk is to the elephant, as the shell is to the tortoise and as the bark is to the tree, so is a large amount of machinery in Canada—a paramount necessity.

THE DAY OF LARGE UNITS.

NOT many years have elapsed since the Canadian General Electric turned out the then largest generator built in this country. It was of 200 kw. capacity. People talked of its immensity and marvelled at what had been accomplished. As endeavor begets success and success further achievement, so a revolution has been brought about in the size of electrical units, as each one built gave experience with which to attempt something on a larger scale.

Recently in the Canadian Niagara power house two 10,000 kw. generators were started and successfully operated. There is now being installed at Shawinigan the largest water turbine in existence, being of 10,500 horse-power capacity, and designs are now being worked out for three others of 13,500 horse-power for the Electrical Development Company at Niagara. Gas engines were used in very small units for a long time after their adoption for power purposes, but we have to-day gas engines in course of construction for a power house in California rated at 6,000 horse-power. Air compressors have been installed with 52 1-2 inch cylinders and 72 inch stroke. These have been accomplished only within the past year. What the limit in size will be and when that limit will be reached, for single units for prime movers it is not easy to say. As a matter of duplication and to offset the disadvantage and loss in case of idleness of large units it is natural to expect that few machines with a higher capacity than 10,000 horse-power will be brought into service.

FIELD OF THE GAS ENGINE.

ABOUT ten years ago it was prophesied that gas engines would, in a very few years, entirely displace steam engines, but the steam engine was too long in the field and too firmly established to be easily discarded. Since then many refinements have taken place in the steam engine to help it keep its hold, but the gas engine has been steadily increasing in popularity, and has in many places superseded the others, but to a much greater extent in England and Europe than in America. This latter is probably due to the fact that gas has not been cheap in America, and electric motors have been introduced in such enormous quantities that gas engines have not been in such great demand.

The idea of deriving power from the energy of an explosion by means of a motor is at least as old as Watt's invention of a means of turning the expansive force of steam to account. Huyghens proposed, in 1680, to make an engine in which the explosion of gunpowder in the cylinder would force the piston forward and so produce power.

No successful working motor was made on this plan nor at this time.

Several more or less successful attempts were made to solve the problem, but the first successful internal combustion motor or gas engine was the Lenoir gas engine of 1860. In this engine a mixture of gas and air was drawn into the cylinder for about half-stroke, the valves closed, and the mixture ignited or exploded, producing thus for the last half of the stroke considerable pressure. This engine was double acting, like the ordinary steam engine, that is, it had the force applied on opposite sides of the pistons alternately. These engines were introduced commercially to some extent, as they ran smoothly and quietly, but consumed a rather large amount of gas. As Watt's steam engine was introduced in 1769, it had a long start on the other. The next great step in advance was the introduction in 1876 of the famous Otto gas engine, and practically all engines built since operate on the same plan.

The greatest thermic efficiency of a steam engine is fourteen and one-quarter per cent., while that of the gas engine might be eighty-seven per cent., and it is quite possible to get in actual practice an efficiency as high as half of this. It might be noted in passing that the cannon is a gas engine, converting heat energy into mechanical, which has an actual thermo-dynamic efficiency of 50 per cent.

The gas engine possesses several advantages over the steam engine, among which are: Cleanliness and freedom from drip, ashes, smoke, and other objectionable accompaniments of the steam engine. The boiler and the danger of boiler explosion are eliminated. A licensed engineer, or even skilled labor, is not required to operate it. There is much less loss of energy in starting and stopping a gas engine than a steam engine, and there is no waste during the periods when the gas engine is idle between runs. On the other hand, gas engines are not self-starting, but require to be turned over by hand, or by some auxiliary motor when used singly. They are apt to stop when overloaded, and the admission of the gas is sometimes troublesome. The cylinder usually requires to be water-jacketed, and even then the high temperature interferes with the lubrication. They are generally accompanied by a disagreeable odor.

The efficiency of gas engines has been, and is now being, steadily increased. At present the consumption of ordinary illuminating gas is about 20 cubic feet per h. p. hour in a fairly good engine of reasonable size. Even better economy than this is obtained, and figures as low as 17, or even 15, cubic feet per h. p. hour are often realized in actual practice.

THE PUBLIC SHOULD BE PROTECTED.

INVENTORS might be divided into seven classes: First, the typical born inventor, who is practical and knows how to work out his ideas; second, one with ideas, but no practical knowledge to win him success; third, the perpetual motion fiend, who is with us always; fourth, the inventor who adapts the ideas of others to his own use; fifth, the crazy inventor, whose specialty is freak notions, such as an apparatus to kill a whole army by means of wireless current at many miles distant, but with no idea of how such will be carried out; sixth, the woman inventor who oftentimes invents ingenious

articles for household use, and seventh, the fraud inventor, who invents only to cheat and defraud. To these might be added another, a combination of the fourth and seventh, who, although an inventor in no sense of the word, exercises a certain amount of ingenuity in adopting the ideas of some one else with which to hoodwink the public to subscribe money to exploit his wonderful invention.

The late Keeley, of motor fame, was a notable example of this class. It is well known how he performed startling experiments, getting enough power from a pint of water to run an ocean liner; how he kept people guessing and paying in funds until his untimely death revealed his hidden tubes and wires, the real sources of the power. This class is more common than might be imagined, only their workings are on a smaller scale than that of the master bogus inventor referred to. It is only rarely that one bold enough to carry on operations on an extensive scale is heard from.

In the last issue, editorial reference was made to a machine as unpracticable as the advertisements of its supposedly wonderful merits were extensive. We were anxious to see this machine, but as yet none is forthcoming. We endeavored to get information, but were given vague replies. When this motor is produced our readers may look for a racy description of it in the power and transmission department.

Using the mails to defraud or deceive or misrepresent is a punishable offence, and in this case we know that such has been done and no action taken by the post office authorities. In the interests of the public at large we would humbly suggest to the Postmaster-General that a thorough investigation be made.

REMOVAL OF DUTY ON MACHINERY.

Toronto, Feb. 11, 1905.

Editor Canadian Machinery, Montreal, Que.:

Dear Sir,—Every few days one hears the announcement of some American firm starting up in Canada, or a Canadian branch being formed to carry on manufacturing of materials and machinery now made solely across the border. This is an effort that deserves some attention and a good deal of encouragement, as it means much to the development of this country.

These enterprises require a large amount of machinery of a class not made in Canada, and at present they are handicapped by a duty. Would it not be good policy to advocate the removal of the duty on all machinery coming under this category and thus stimulate Canadian manufacture? I have been thinking of this matter for some time, and would like to see some move made in that direction.

Yours very truly,

Member Canadian Manufacturers' Association.

(This question is of unusual importance to all manufacturers in this country, as well as to machinery manufacturers abroad. We would be glad to receive opinions from those interested giving expression to their views on the subject.—Ed.)

ELECTRIC PRODUCTION OF STEEL.

FOR some time past the Dominion Government have been investigating the methods of the production of iron and steel by electricity, and the issue of their report embodying the results of their researches, marked the most important event in electro-metallurgy within the past year, which otherwise saw little of note towards the development of that science. By sending Dr. Haanel, Superintendent of Mines, accompanied by a suitable staff, to Europe, where a close study was made of existing methods, carried on in a more or less desultory way, they were enabled to collect everything of importance pertaining to the subject. The report contained exhaustive descriptions of all the processes in use, together with the cost re-calculated to Canadian prices of power, labor and material, and relative feasibility, each account being accompanied by diagram and descriptive drawing.

In a paper on the Electro-thermic Production of Iron and Steel, read before the Canadian Society of Civil Engineers at their annual meeting, Dr. Haanel stated that beyond question the electric manufacture of high-grade steel was commercially practicable, and that the manufacture of ordinary sheets would soon also be affected. He predicted a rapid advance in the development of electric method. The limit of economic production by methods now in use has probably been reached; at least no startling reduction in cost is probable, whereas the electric processes have been put to the test sufficiently to justify the belief in their great commercial importance.

All practical application in this direction will bring into use the water power of northern Quebec and Ontario to reduce the ore, there present in such vast quantities; and the day is not very far distant when an unprecedented development of our northern mineral resources is assured.

A UNIVERSAL UNIT OF MEASUREMENT.

NO great change or radical departure from ordinary custom, whether for good or evil, has ever been effected without great resistance on the part of some directly or indirectly interested. That the metric system will be adopted as a standard of weight and measurement throughout the world there is little doubt, but the bitterness of the opposition to be overruled before such can be accomplished has already been shown. However, both in Canada and the United States enough of sentiment has already been expressed to show that popular feeling is in its favor.

Of necessity, before the adoption of the metric system can be accomplished an entire revolution in the design of machinery and machine tools must take place which can be done only by the expenditure of millions of dollars and enormous labor.

In England, Lord Kelvin, who is perhaps the greatest living scientist and philosopher, is an enthusiastic advocate of the system and through his efforts a bill for its adoption in Great Britain, in April, 1906, or at a later date fixed by the Government, has passed its second reading. In Canada this system is favored throughout and its adoption advocated by the Canadian Manufacturers' Association and the different boards of trade in the country. Throughout the manufacturing and commercial world a feeling favorable to the metric system has been growing stronger and stronger, so that there is every evidence of its universal adoption within a few years.

Something About Ourselves

SINCE the appearance of the first issue of Canadian Machinery and Manufacturing News, many expressions of appreciation have been received from all sides, and particularly from those who had been looking forward with interest to its advent, and speculating as to its probable merits. Not only in Canada, but in the United States has the value of a paper, as well as the necessity of one covering the machinery field in the manner of Canadian Machinery and Manufacturing News, been recognized. From all quarters opinions and congratulatory remarks have been expressed, testifying that its usefulness is confined to no one class. Letters and favorable expressions of opinion have been received from power companies, from manufacturers, from superintendents and foremen, from machinists, from professional and operating engineers, from contractors and builders, from professors in the technical colleges, as well as from a host of business men interested in machinery, showing that its scope is by no means limited.

When the first announcement was made, a 52-page paper was proposed, but the support given was such as to warrant even larger, and a 64-page paper was produced. This issue contains 72 pages, with a guaranteed circulation of 8,000 copies each issue. Any news of new machinery or power and transmission appliances brought to notice by readers will be appreciated, and correspondence on practical subjects is solicited with sketches and diagrams, and for same payment will be made. A few of the many testimonials received are given:

Quebec, P.Q., Jan. 24, 1905.

The Canadian Machinery and Manufacturing News, Montreal:

Dear Sirs,—Your first copy received, and it certainly does you credit as to the admirable way in which it is got up.

Mechanics' Supply Co.

Cincinnati, Onio, Jan. 23. 1905.

The Canadian Machinery, Toronto, Canada:

Gentlemen,—We have your favor of the 20th; would say that we received the first issue of your paper and are very well pleased with its appearance; considering that it is your first issue, we think you have done some very good work.

The Cincinnati Planer Co.

P. O. Box 911, Pittsburg, Pa., Jan. 24, 1905.

Mr. J. B. Maclean, President The MacLean Publishing Co., Limited, Montreal, Quebec, Canada:

Dear Sir,—Permit me to congratulate you on the appearance of your first number. You have established a standard which your competitors will find it hard to maintain. Being much interested in the subject of technical education, I note with considerable pleasure what you say about technical education in Canada. We are at work on the same problem and the Electric Club Journal has acquired a very large circulation among the Canadian technical schools. From time to time you may find in our pages things of interest along this line.

Believe me,

The Electric Club Journal.

We have received the first issue of Canadian Machinery and Manufacturing News, a monthly paper devoted to the machinery and electrical trades, and to all users of power. It is got up in magazine form, abounds with illustrations, contains a number of special articles of great interest to the mechanic, as well as a most promising editorial department devoted to the discussion of technical subjects. The new magazine should make a place for itself in the home of the Canadian workman.—Vernon News.

Flashlight of the staff of The MacLean Publishing Co., taken at the First Annual Banquet of the Company, Queen's Hotel, Toronto, December 31st, 1904.

112 Nicholas street, Ottawa,
Feb. 6, 1905.

Canadian Machinery and Manufacturing News, Montreal:

Dear Sirs,—As I am the engineer of Woods, Limited, I was glad to run across the January number of Machinery and Manufacturing News, and think it is a grand thing to have such a paper, as all of us engineers have to send to the States if we want any news of the trade at all. I take four papers from there, and I think it is every engineer's duty to patronize a good Canadian paper so valuable as yours. As you are willing to send it for six months for 25c. please send it to me, and at the end of that time I will renew my subscription with greatest pleasure.

I remain,
Yours,
Chas. Berry.

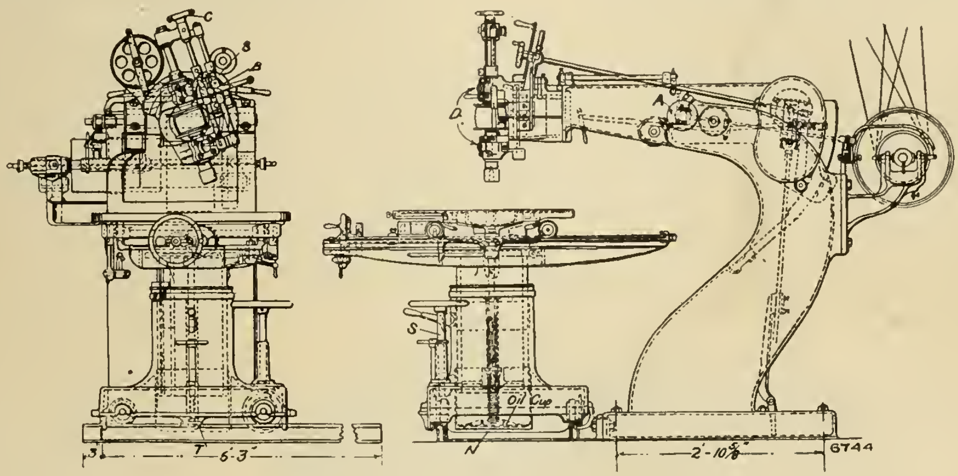
Machinery Development

Metal Working — **Wood Working**

A NEW MECHANICAL WOODWORKER.

A NEW and ingenious mechanical woodworker has recently been installed in one of the Government factories in England. The machine, which is the outcome of many years persistent work and costly experiments, possesses features of more than ordinary interest to wood-working manufacturers, and to engineering patternmakers, as it takes a parallel place with the universal milling machine in ironwork over which, however, in many movements it goes further, viz., in the canting of the splindle-head, and the range of adjustment vertically and laterally. This universal movement of action and range of adjustment adapts it for a large variety of work, and renders it alike valuable in the small works where a very limited plant is available, and in large concerns where there is a highly specialized plant, the adjustment of which it is unadvisable to upset for ever-varying and awkward jobs.

The machine which is illustrated in perspective, front and side elevation at Figs. 1, 2 and 3, is self-contained, and occupies a comparatively small space. With the exception of sawing, planing and thicknessing, it can be economically employed on the following operations which, although not representing the full compass of the machine, will nevertheless serve to give an idea of its scope; regular and irregular moulding, tenoning, haunching, cross-cutting, housing, dovetailing, boring, slot-mortising, recessing and trenching, turning, fluting, shaping square, and moulded work of every description.



A New Mechanical Woodworker.

The machine consists of strong solid cored frame of cast iron supporting an overhanging extension arm carrying a spindle-head. The arm rocks vertically on sensitive bearings, and can be depressed to a low angle. It has an exceptionally long over-reach, well clear of the main frame. On the latter are two trunnions, A, supporting the overhanging arm, which is of cast iron and half-circular in section. The range of its rise and fall is 16 in. At the front of the arm is large spindle-head, the form and combinations of which form an essential feature of the machine. This head, which consists of a solid casting, is pivoted to swivel to any desired angle, from the vertical to the horizontal, and end for end, the motion being provided with a graduated scale, B, for instantly setting to any desired angle of cut. On the spindle-head are arranged the plummer blocks carrying the spindle. The latter has a reversing motion and is free to slide within its bearings independently of any movement of the head, and is fitted with a quick-acting positive adjustment and a micrometer screw adjustment for fine work, this being regulated by the sector S, and effected by the handle C. The spindle, which is of the best forged steel, is rotated by a pulley keyed on to it and driven by a belt from the countershaft. To allow for the driving at any angle of inclination of the arm, compensating pulleys have been fitted within the latter. Particular care has been bestowed upon the spindle bearings D, those portions which are subjected to the greater pressure owing to the pull of the belt being in phosphor bronze, while the lubricating sides are of white metal.

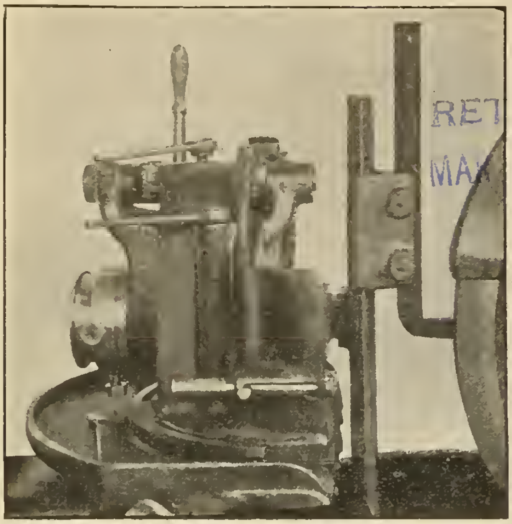
The table mounting is a heavy cored casting free to move bodily upon its foundation frame on runners which are actuated through a pinion spindle and hand wheel S. The rollers run on a rail frame fastened to a floor or a concrete bottom. The table can be instantly moved across the front of the machine from under the cutter spindle and sideways clear altogether of the machine head in which latter position the spindle head can be lowered under the level of the table top. The table carrier can be secured in any position by the clamp T.

The table is carried on a column accurately fitting the outer body, both column and table being raised and lowered through a distance of 12 in. by means of a screw, N, which passes through a sleeve cast into the column. In addition to the lateral movement of the table body, the table is provided with a longitudinal and cross motion and is moved upon runners actuated quickly either by hand or by positive screw and rack motion. Further, it can be turned through a complete circle horizontally.

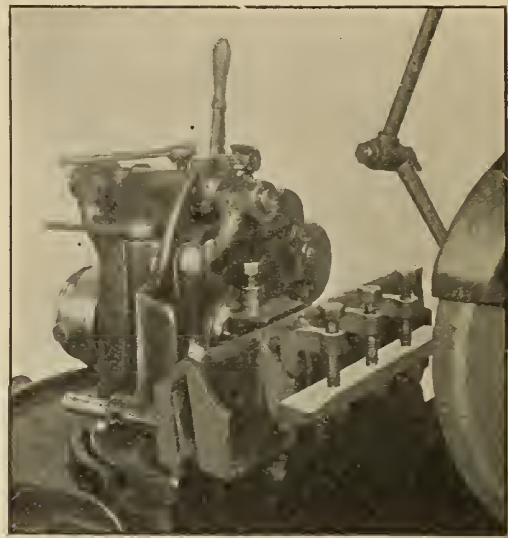
These combined movements enable the work to be firmly fixed flat upon the table any angular cuts and adjustments being made by turning th etable horizontally and swivelling the machine head vertically. The work need only be rough set the fine adjustments being readily effected by the screws. Automatic stops are fitted throughout to facilitate and tender accurate repetition work.

The machine is driven in the usual

way by belting from a main shaft the pulleys running on a countershaft supported by two brackets which are bolted on to the back of the frame casting. The striking gear is arranged behind the spindle head and can be actuated from either side. When arranged for electric driving the motor is fixed on the countershaft brackets, and drives direct on to the pulley shaft.



Supplemental Chuck as used for the End Face of a Hook Tool.



Supplemental Chuck as used for Turning up the Bottom of Tools.

As much attention has perhaps been bestowed upon perfecting the cutters as on the machine itself. They are of solid turned type which keep their form longer than most cutters owing to their being sharpened and ground on the inside edge. They are made of special steel and formed to gauge, to ensure accuracy or fit to the scribed or other parts. They are made in great variety to suit the varied range of work which the machine is capable of executing.

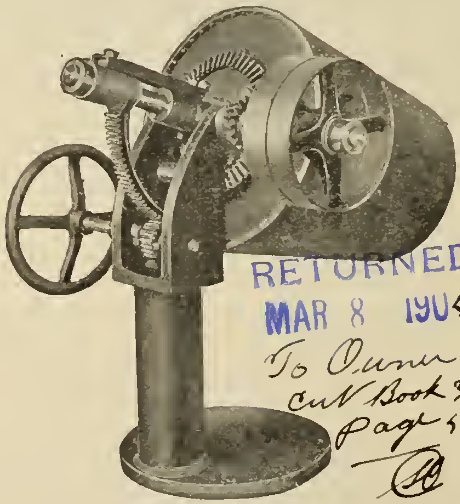
With suitable dividing heads attached to the table top any gear pattern with helical, spiral, straight or other teeth can be cut, similarly as iron gear wheels are cut in the milling machine. The cutters, however, are not the costly item as are milling cutters. A very plain, simple, flat, inexpensive cutter only is required, which it will pay to make to cut any one single gear pattern.

In addition to the time saved over hand labor the teeth in this case can be cut out of a solid block of suitable wood roughly sawn to diameter as accurately as those of any iron wheel cut in a miller, which is a very different matter when gear patterns are cut by hand, however skilled the workman.

Straight round cored boxes up to 12 inches diameter, or larger if necessary, or pipe bends any radius can readily be worked with saws and other simple inexpensive cutters. Boxes trenched out square section to any desired width with reduced ends can be cut out of the solid. Core boxes up to 28 feet radius forming the socket and spigot ends complete have been cut by the machine.

In small, plain, straight core boxes a bead and groove each side the core groove is formed all at one time obviating the necessity of pegs for fixing the two halves in strict relation to each other.

Routing out of solid bodies and forming webs out of the solid can be rapidly and accurately worked with very simple cutters, as can heavy work on cylinders.



Tilting-Tumbling Barrel.

UNIVERSAL GRINDING MACHINERY.

To efficiently grind steel tools by means of rapid-cutting wheels, it is absolutely necessary that the contact between the two should be a line and not a surface.

Hence, if it is desired to grind the plane face of a tool, the wheel must have a cylindrical or conical surface, past which the surface to be ground must be moved in a plane.

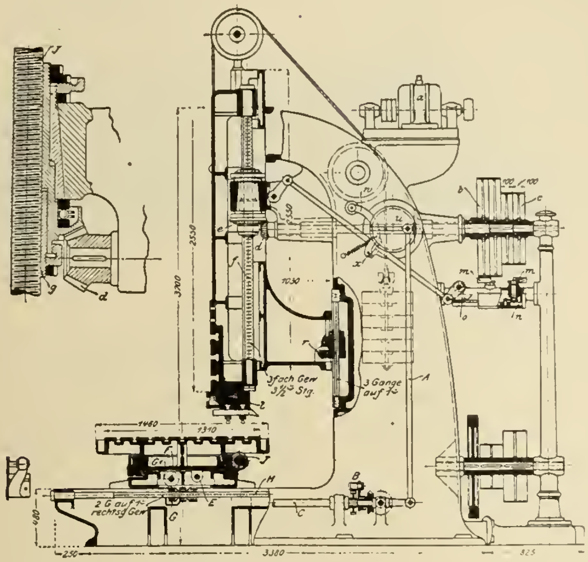
A plane face of the wheel cannot be used for this purpose, because it and the surface being ground would soon coincide, with the results of no cutting and much heating. The tool should be clamped in the holder against its base, or the surface upon which it rests when in use, in order to avoid any errors due to want of parallelism of its sides, and to enable it to be re-ground with a minimum of loss. All of its plane faces should be ground without altering its position in the holder, to insure accuracy of the angles and uniformity in results. This requirement is particularly important in thread tools for the grinding of which these machines are of the utmost benefit.

The tool holder should be capable of presenting the tool to the wheel in such a manner that any face can be so ground as to have a definite predetermined relation to the other face, and to the shank and the adjustments necessary to accomplish this must be easily understood and quickly manipulated.

Experiments made by William Sellers, of Philadelphia, demonstrated that for roughing cuts, a curved cutting edge is more efficient than a straight one, and that different materials and different depths of cut require different degrees of curvature; also that the cut should be a draw out and not a gouging out, so that the bulk of the metal would be removed ahead of the point of the tool. This adds greatly to its life, the point being the most delicate part. The machines are supplied with holders to be used when grinding curved faces, and gauges for setting the tools in their

holders so as to produce our standard shapes as given by the reference tables accompanying the machines, but means are provided for producing any other shapes that may be preferred.

For boring or chasing tools, which are usually bent at right angles to the shank, a special holder is furnished which, when inserted in the regular holder, enables such tools to be ground in the same manner as the outside turning tools. The advantage of being able to grind a chasing tool which will make a female thread, having absolutely the same shape and angles as its male mate, which has been produced by a tool ground in the same manner, needs no comment. The only shapes of cutting edges which cannot be ground on these machines are concave curves and reentrant angles less than ninety degrees.



German Slotter.

THE GLOBE IMPROVED TILTING TUMBLING BARREL.

THE improved oblique tilting tumbling barrels manufactured and placed on the market by the Globe Machine and Stamping Co., of Cleveland, O., are adapted to clean, smooth, brighten or polish sheet metal stampings, small iron or brass castings, drop forgings, rods, rivets, pins, washers, screw blanks, etc., etc., giving, it is claimed, a much finer finish to the work than can be obtained by the use of the ordinary horizontal type of tumblers. The tilting tumblers can be used for either wet or dry tumbling. Many advantages are claimed for the oblique tilting tumbler over the horizontal barrels: for instance, if desired, the work can be seen during the process of tumbling, and samples of the parts in work may be taken out during the operation without stopping the machine, and progress of the finish may thus be inspected.

A ratchet and pawl on the hand wheel shaft holds the barrel in any desired position, and by means of the hand wheel the elevation or angle at which it is desired to operate the barrel may be adjusted to suit the requirements of the parts to be operated upon.

It is sometimes desirable to use sawdust or ground leather in finishing parts in these machines, and in such case, after the parts have been sufficiently operated upon, a sieve cap is fitted to the open end of the barrel, replacing the steel cap referred to above. The barrel is then lowered as far as possible, allowing it to run as usual, and the sawdust or ground leather will then work out through the sieve cap in a few moments, leaving the tumbled parts in the machine, bright, clean and free from dirt or dust. The sieve cap is then removed and the parts will slide out into a suitable receptacle placed in front of the barrel to receive them.

A heavily-made oakwood barrel is furnished on these machines, instead of steel barrels, when preferred by purchasers. The No. 16 oblique tumbler weighs about 425 pounds. The barrel is 22 inches diameter at the large end, 16 inches diameter at the small end, and about 24 inches deep. They run at about 40 r.p.m. They have tight and loose pulleys. The Globe Machine and Stamping Company issue a neat little special circular describing these tumblers.

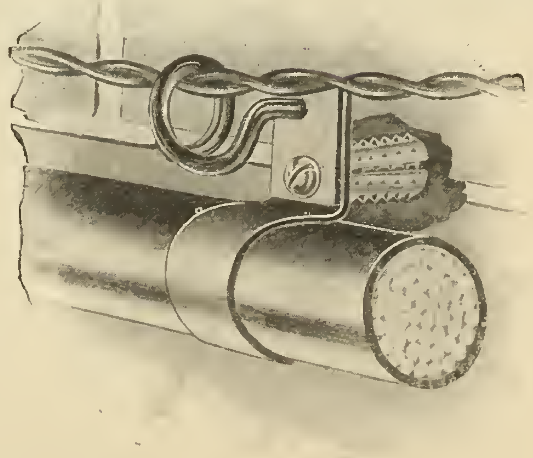
SLOTTING MACHINE.

SLOTTING machines are generally crank or gear driven. The illustration represents a slotter with a spindle-driven cutter bar. The maximum stroke is 47¼ inches (1,200 mm.), and the distance from face of cutter bar to column 40⅝ inches (1,030 mm.). The cutter bar carries removable tool clamps and a relief tool holder similar in construction to those employed on planers, and the latter can swivel to any desired angle.

The spindle has triple thread 3½-in. pitch; the nut is solidly secured in the column, and is made of two parts to take up any lost motion occurring. Fig. 4 gives an enlarged section of the spindle, nut and gears. The tool bar feed thrust is taken up by a ball bearing, the return thrust by a hardened and ground washer K. The bar returns 2.21 to 1.

The bar slides in rectangular guides and is counterbalanced by a weight within the column.

The table is 51½ inches (1,310 mm.) in



Long Saut Cable Clamp.

diameter, has a longitudinal traverse of 50 inches, and a cross traverse of 62 inches. The rotary motion is implies by worm J—the worm wheel being covered entirely. Every movement of the compound table can be made by crank handles or by power transmitted to them by the cam disc U and gearing as shown in cut.

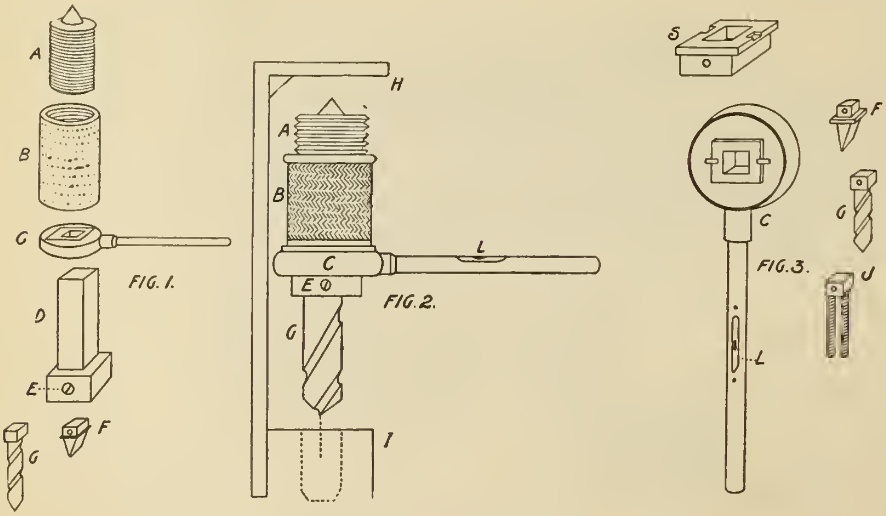
The tool is driven by a 5 h.p. variable speed motor with double countershaft. The belt shifters are of the planer design, and are connected with adjustable knock-off to regulate the stroke of tool bar.

The machine was built by Ernst Dania of Vienna, for the Union Electric Co., of the same city.

A HANDY RATCHET DRILL.

SOMETHING new, and of great interest to machinists and users of tools, is the handy ratchet drill shown by the illustration accompanying this acticle. The new drill is in six pieces, and is shown in several combinations in Figs. 1, 2 and 3, in each of which the parts are correspondingly lettered as follows: A, feed screw; B, knurled feed; C, ratchet; D, chuck; E, set screw; F, screw driver bit; G, drill bit; H, rim of pulley; I, hub of pulley; L, level in handle of ratchet; S, bushing; J, tap.

The merit of this tool is in its great adaptability. Each piece fits snugly into its place. When used as a wrench or screw driver the tool may be used right or left-handed by turning the ratchet over. The handle may be taken out and used as a level; the bushings are in six sizes from ½ in. to 1 in.; screw driver bit, four sizes; tap, six sizes.



A Handy Ratchet Drill.

Such a tool made by a skilled workman from the proper materials would be a convenience hardly to be overestimated.

DOWEL MACHINE.

A DOUBLE dowel machine has been invented and designed by Clark & Demill, Galt, Ontario, recently. With it is supplied a detached countershaft, which may be placed wherever desired, giving a long belt and making the machine much more powerful.

Column—The column is of neat design, with cored centre.

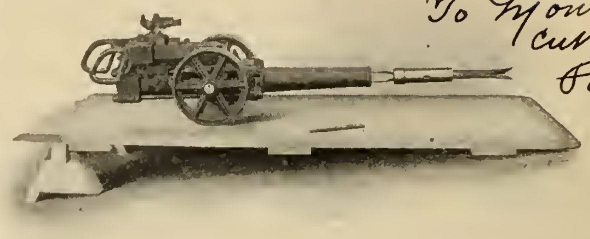
Gearing—Cut gearing is used on this machine, which insures an even, smooth feed, and produces very smoothly-finished dowels.

Rolls—The rolls for discharging material are grooved in a perfect circle and will not dent or deface the finished rods in the least.

Feed—The feed consists of an $1\frac{1}{2}$-inch belt from cone pulleys on the countershaft to cone pulleys on the counterworm and worm wheel to rolls. Cut gearing connects top and bottom rolls.

Capacity—A sleeve passes through the spindle to within ¼ inch of the heads. This machine is made in several sizes, turning to $1\frac{1}{2}$-inch diameter, and larger sizes if ordered, allowing dowels to be made on this machine as short as 6 inches.

With each machine is furnished two heads with cutters and grooved rolls and sleeves to match the heads. Machine weighs 1,100 pounds, and is designed to run at 800 r.p.m.



Improved Coal Cutter.

NEW INGERSOLL COAL CUTTER.

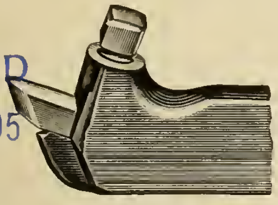
AMONG the products of Allis-Chalmers-Bullock, Limited, Montreal, are the several classes of mining machinery, one of which is illustrated herewith.

The "New Ingersoll H." coal cutter is the most modern of what is known as the percussion type of cutter, familiary called "puncher" by the miner. It is used for undercutting the coal before the mineral is blasted down. For many years after the introduction of coal mining machines to replace the laborious method of hand mining, great trouble was experienced in securing buffers for the piston in case it missed the coal. This machine, since put on the market, has revolutionized the operation, for it is provided with air cushions both back and front, and is thus under complete control. The strain on the operator was eased, and he was enabled to increase to a marked extent his daily tonnage. This cutter is used extensively by the Dominion Coal Co., the Nova Scotia Steel and Coal Co., and other companies.

CUTTING OFF AND GRINDING MACHINE.

IN the manufacture of tool holders it is necessary for us to cut off large quantities of self-hardening steel into cutter lengths. Experience has taught that this class of steel gives best satisfaction when cut off cold. The ordinary shop practice has been to cut the steel off hot or break it off on the anvil. The objection to the latter method is that it is dangerous and the break is liable to be very irregular, resulting not only in a serious loss of steel but also in vastly increased grinding, with attendant waste of time and emery wheels.

After years of experimenting with various methods of doing this work Armstrong Bros., Chicago, have developed the machine illustrated, which, in a slightly different form, has been in use in their works for some time, giving perfect satisfaction and with practically no expense for maintenance. The cutting is done by a disc of special tool steel revolving at high speed. The per-



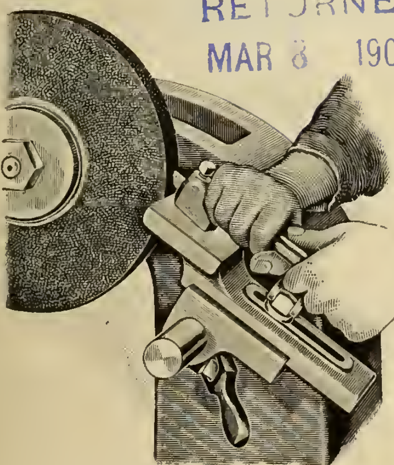
3/Ground away and weakened by holding cutters in Tool Holder when sharpening.

iphery of this disc is coated with self-hardening steel particles, this coating doing the actual cutting and making a clean cut incision, while the disc itself wears but little.

It is not adapted, or intended for use on any other metal than self-hardening steel. Start slowly and don't begin cutting until the machine has attained full speed. Don't try to cut bar entirely through; cut a nick on each side of bar 1-16 to 1-8 inch deep, according to size, and break it off with a smart blow of hammer. See that bearings are thoroughly lubricated, especially when new.

The accompanying illustration will give a clear idea of method of grinding cutters.

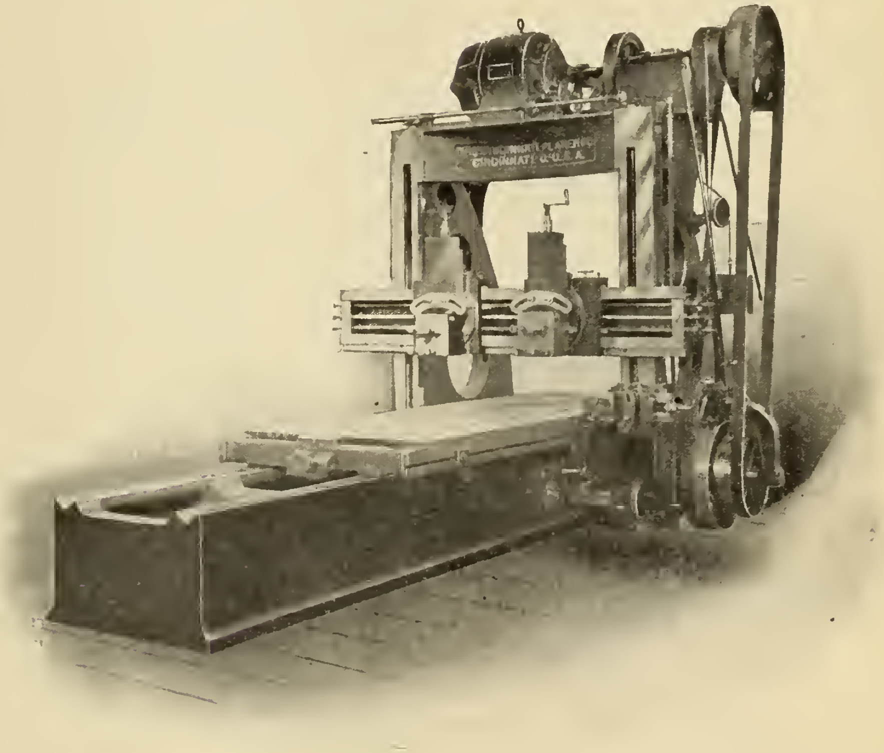
An important feature of the edsign and construction of this machine is that both operations, cutting off and grinding can be carried on at the same time with-



Cutting off and Grinding Machine.

out the slightest inconvenience or interference of one with the other

The arbor is of high carbon spindle steel, ground true. Bearings are cast iron and are dust proof, with convenient and positive adjustment for wear and to take up lost motion. The swinging table is provided with a length gauge and is conveniently adjustable for steel of different sizes or depth of cut. The cutting disc is securely clamped between two boiler plate flanges and is provided with a neat guard which can easily be swung back out of the way when changing disc. The emery wheel is 12 in. diameter and is provided with an improved rest adjustable to any angle or clearance and varying diameter of wheel. The countershaft is well designed; loose pulley has an extra long hub and is oiled through end of shaft. All bearings are fitted with finished cast brass grease cups.



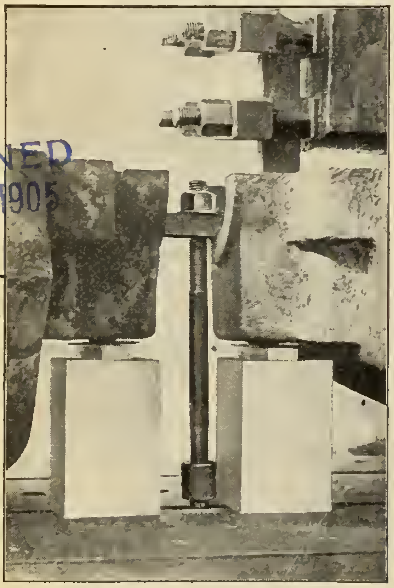
Cincinnati Motor Driven Planer.

THE CINCINNATI MOTOR-DRIVEN PLANER.

THE accompanying half-tone illustrates a new motor-driven planer, having a variable speed-cutting stroke, with a uniform return at all times, and using a constant high-speed standard motor. The engraving shows how the power is transmitted from the motor to the rear or constant speed shaft by a pair of gears, one of which is rawhide to obviate noise. This first or constant speed shaft carries the return pulley, and therefore gives the table always one speed for the return stroke. On this shaft is also mounted a heavy fly-wheel, to relieve the motor at the reverse, which is placed between two bearings, all of which are made ring oiling. The pulley for the cutting stroke is placed on a separate or forward shaft on top of the housing, and power is transmitted from the constant shaft to this one by two trains of gearing, each giving two speeds to the platen by simply moving one or both of the two levers shown on the side of planer. The changes can be made while the machine is in operation or standing idle. This makes an ideal drive, especially for large machines, when it is desired to place them under the crane or where there is no room overhead for any style or variable speed countershaft; and it also overcomes the two chief objections to a planer driven by a variable speed motor, which reduces the power on the slow speed and runs the return speed far beyond its limit when a high cutting speed is desired. Variable speed motors are rarely carried in stock, and must therefore be ordered specially, which usually means a long wait, not only for the new motor, but also for any repairs, should they be needed later on. The cut illustrates a 48 x 48 inch planer, but this same style drive can be applied to all other sizes of machines which the Cincinnati Planer Company, Cincinnati, manufacture. The speeds used on the machine illustrated were arranged for 20, 25, 30 and 40 feet per minute, with a constant return of 80 feet. A brass index plate is fastened to the side of housing (not shown in cut), so that a glance will tell what speed is being used.

DROP FORGED T HEADS.

While high speed steel has done much to reduce the time required to turn out work on machine tools, the increase in output from the planer, boring mill and similar machines has not been as great as was expected. Upon observation of the time required for the various operations of chucking leveling, clamping, etc., and actual cutting it has been found that the time required for cutting is on an average 50 per cent. of the total. It is claimed that this is largely due to the poor quality and inadequate supply of bolts at the machine. The ordinary commercial bolt is not suitable for this work of clamping because they are apt to fail, and when the heads are ground to enable them to be inserted after the work is set they are apt to break in the neck, and therefore are unreliable.



Drop Forged T Head in Planer.

The T bolt head here illustrated and described was developed in a large shop where difficulty was experienced due to the breaking of T bolts, where the necessity of carrying a large number of bolts of different lengths for the variety of work handled by the machine in the course of a day was experienced, and where time was often lost due to the necessity of having bolts of special length forged.

This T bolt head is drop forged of high carbon steel, and thus are very durable. Any number of studs of any length can be made in the bolt cutter, and can be quickly renewed at slight expense. In shops not equipped with screw machines, a hand die will do the work. The ease and rapidity with which these studs can be made insures a good supply being on hand at all times.

The inner side of these heads are faced true in order to present a good surface to the planer slots. They are case-hardened thus preserving the sharp edges so necessary on a T head.

The accompanying cut shows the T head in use on a 72 inch planer in a large and modern shop. These heads are made by A. R. Lang Co., Cincinnati, O., who make sizes to fit any machine.

A NEW FRICTION BALL-BEARING DRILL.

This drill occupies little floor space, belts direct to main line shaft, requires no countershaft, has wide range of capacity, and is designed to meet the growing demand for a light, sensitive drill that will handle the new high-speed steels. It has several features that are original.

The friction plate is on top of the driving pulley. By this arrangement all dirt is kept from the friction plate and driving pulley, and the weight of the friction plate and shaft is always on the driving pulley, therefore a forced contact by means of a screw is largely unnecessary. However, a screw is provided on top of the friction-plate shaft, which may be tightened with your fingers, and on which a wrench should not be used.

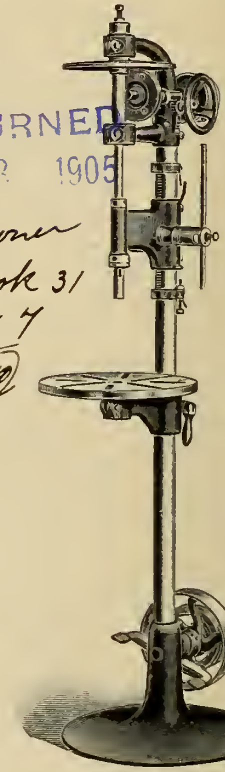
This screw rests on a ball-bearing plate with a spring to give a flexible pressure on the plate shaft which runs on ball bearings. By turning the hand-wheel on the right-hand side of the machine, a speed variation of from one to three can be obtained instantly without the bother of changing belts.

Another decided original feature of this machine is in the head, which slides on the standard, giving a travel of 10 inches to the spindle. The spindle has a ball-bearing thrust collar and will be provided with Morse Taper No. 1 unless otherwise ordered. No. 2 Taper can be furnished without extra cost. With the head sliding in this manner, the spindle is rigid in all positions, the lever can be adjusted to any length and position desired. Stop collars are provided to gauge the travel of the head, the lower one having an adjustable screw for gauging the depth of hole more accurately. The head is counterbalanced by a spring that can be adjusted to any degree of sensitiveness.

Another very desirable and original feature of this machine is the friction clutch on base. The right foot presses down the lever on the right, which starts the machine, and the left foot pressing down on the lever on the left side will stop the machine. This drill was built by the Francis Reed Co., Worcester, Mass.

NEW CABLE CLAMP.

A new cable clamp called the Long Saut has been placed on the market, the general arrangement of which is shown in the accompanying illustration. As will be seen, this arrangement provides a secure fastening for attaching pipe conduits or lead covered cables to brick, stone, concrete or wood, as well as a support for bridle rings to carry bridle wires. The clamps are heavily galvanized and made in four sizes for carrying lead covered cables from 3-4 inch to 2 inches diameter. The bridle rings are made with machine thread for screwing into the clamp and can be furnished either galvanized, brass or enamel. The clamps will not dent or injure the lead-covered cable in any way as is the case where spike cable dogs are used. But one expansion shield (furnished with the clamp if desired) is required for fastening this clamp to the masonry. This alone is a great saving, as it requires the drilling of one less hole than when spike dogs and separate bridle rings are used, besides the fact that the clamps cost less than the other articles. The expansion bolt insures a more secure fastening than where cable dogs are used. Full information may be obtained by addressing the Diamond Expansion Bolt Co., or 9 Murray street, New York.



Ball Bearing Drill.

Practical Questions and Answers

Motor Testing in Practice.

Ques.—In electrical manufacturing establishments where they are turning out a large number of machines of the same kind, is every machine tested separately, or how is it accomplished?

Ans.—Where a large number of machines are to be tested, the saving of power is an important factor, and two machines of approximately the same size are tested at the same time, belted together, one running as a motor and the other as a generator. This is called Hopkinson's method, and is known in the shops as pumping back. A small amount of additional power is supplied to overcome all the losses due to friction, hysteresis, eddy currents, slipping of belts and excitation current. Special care is required to supply suitable conditions for starting. The voltage of the three machines is regulated by means of rheostats inserted in the field circuits. In the circuit between the loss supply and the motor are located an ammeter and starting rheostat, and connected between the motor and the generator are an ammeter and a switch. The loss supply being brought up to voltage, the motor is started. This necessarily runs the armature of the generator and the machine picks up, generating the field current. The field rheostat is then regulated so that the voltage across the brushes of the generator is about three volts higher than that of the motor, and the loss supply. Then the speed being correct and the voltage across the switch about three volts, the switch is thrown in and the machines pump back their current on each other, then to bring the machine to the required load the motor field is weakened. In tests of this kind from actual observation, machines of 2100 k.w. capacity have been run at full load with an expenditure of only 400 h.p. from the engines. The machines may thus be run at full lead, the compounding of the generator and readings being taken as before.

High Compression in Automobile Motors

Ques.—Is it advisable to carry higher compression than 100 lbs. per square inch on an automobile motor using jump spark ignition?

Ans.—A few high-speed automobile motors have compressions of 125 lbs. per square inch. They give their best results, however, only with automatic carbureters, which give weakened mixtures when the engine runs fast.

With an engine liable to become the least overheated or which is required to run at less than 700 or 800 revolutions a minute, higher compression than 80 lbs. is not advisable on account of the danger of premature explosion or backfiring.

High compression means high explosion pressures and calls for much stronger parts, such as crank, connecting rod, etc., as well as for much more ample bearings than when the engine is designed for moderate compression.

Theoretically, the higher the compression the more economical the engine; but in practice there are other things to take into consideration; particularly the cooling effect and leakage in engines of such sizes of cylinders as are used on automobiles.

A compression of 125 lbs. per square inch requires that all parts of your engine should be designed to stand explosion pressures of 500 to 520 lbs. per square inch.

A compression of 80 lbs. requires provision for pressure of about 425 lbs. maximum.

While with a compression of from 50 to 60 lbs. you have to provide for maximum strains due to only 280 to 300 lbs. per square inch.

Using flywheels of the same diameter in each case, one of much less weight will do with 60 lbs. compression than with higher; and since the theoretical gain of higher compression is usually lost in practice through the greater leakage, etc., it is found that for all-round service and even for economy of fuel, a small engine using 60 lbs. compression does as well in actual practice as an engine which uses twice as much compression. The light compression, too, makes the engine easier to start.—Gas Power.

To Distinguish + and – Dynamo Leads.

Ques.—How can I find out which is the positive and which the negative leads of a direct-current dynamo before connecting it to the switch board?

Ans.—By means of a Weston or other permanent magnet type of voltmeter this may be accomplished. Apply leads from the voltmeter to the different pairs to brushes, if more than one pair. If the lead of the voltmeter marked X is connected to the positive brush and the — to the negative, the voltmeter will read the voltage of the machine, provided the proper range of instrument is used, otherwise the voltmeter needle will be thrown against the back step.

Principal Alloys.

Ques.—Would you kindly furnish me with a list of the principal alloys in use and the metals that go to make them up?

Ans.—A list of the alloys and their constituent parts is given:

A combination of zinc and copper makes bell metal.

A combination of copper and tin makes bronze metal.

A combination of antimony, tin, copper and bismuth makes britannia metal.

A combination of copper and tin makes cannon metal.

A combination of copper and zinc makes Dutch gold.

A combination of copper, nickle and zinc, with sometimes a little iron and tin, makes German silver.

A combination of gold and copper makes standard gold.

A combination of gold, copper and silver, makes old standard gold.

A combination of tin and copper makes gun metal.

A combination of copper and zinc makes mosaic gold.

A combination of tin and lead makes pewter.

A combination of lead and a little arsenic, makes sheet metal.

A combination of silver and copper makes standard silver.

A combination of tin and lead makes solder.

A combination of lead and antimony makes type metal.

A combination of copper and arsenic makes white copper.

Evaporation in a Boiler.

Ques.—In an article on the Use and Abuse of Steam Boilers in your January issue, in the formula for finding the equivalent evaporation, in one place the figures 966 occur and in another 968; which is correct?

Ans.—The figures 966 are correct, the other was a typographical error. This figure represents the number of degrees Fahrenheit through which water at boiling point and at atmospheric pressure must be heated to produce steam. It is called the latent heat of steam.

Temperature of Flame.

Ques.—Is there any data on the subject of approximating the temperature of a flame from its appearance?

Ans.—M. Pouillet, an authority on the subject, gives a table of the appearance of a flame and the appearance in degrees Fahr.:

Appearance	Temp. Deg. F.
Red, just visible	977
Red, dull	1290
Red, cherry, dull	1470
Red, cherry, full	1650
Red, cherry, clear	1830
Orange, deep	2010
Orange, clear	2190
White heat	2370
White, bright	2550
White, dazzling	2730

The Value of Trade Paper Advertising

ONE needs but a brief insight into trade paper advertising to be strongly impressed with, first, the large amount of money spent, and second, the large amount of money wasted therein.

Consider for a moment the difficulties under which the general advertisers labors—and succeeds.

Not one in a hundred of the readers of a general magazine or of a newspaper is likely to be interested enough in his ad. to read it. Yet so skilfully is the advertising conducted that a sufficient number of those who do read, buy and thus make the advertising profitable.

The trade paper advertiser on the other hand, not only reaches **a selected list of prospective customers,** every one of whom is directly interested in his proposition, but he is also able to lay before that list, every week, or every month, a different presentation of the selling points of his article.

If general advertisers enjoy such a tremendous advantage, they could all make money faster than they could spend it.

The trade paper advertiser's opportunity is limited only by the circulation of the mediums.

And how does he handle this unequalled opportunity?

He grudgingly buys a "card space" in a list of papers of greater or less advertising value, and puts in the space something like this:

There! If any one wants to buy a Jones Corliss he will know where to find Jones.

Or, if he prefers a Smith Corliss, he can get the address of Smith & Co., from a similar ad.

The difference between such advertising and good advertising is the difference between the small boy behind the counter, who hands out what an old customer asks for, and the competent salesman who goes out and finds a new customer and induces him to place a first order.

The good trade paper is a competent salesman who calls regularly on a large list of buyers.

But he is dumb.

All he can do is to open the page that bears your ad. and show it to the subscriber. He shows him Jones & Co.'s ad. He knows what a good engine Jones makes, but he cannot say a word.

The subscriber has seen Jones' ad. before— for three years. The same old ad.

He is glad to note that Jones still lives, but tells the silent salesman to turn over the page.

"Find me an ad. that says something about engines,—one that will help me buy the right kind of an engine."

The silent salesman gladly turns the page to Brown & Co.'s ad., because Brown knew he was dumb and has made the ad. do the talking.

It tells all about the Brown engine and why the subscriber needs it in place of any other engine.

The Jones engine of the Smith engine may be as good as or better than the Brown for the subscriber's purpose, but he does not know that.

Of course their salesmen have called on him, when he did not want to buy an engine, and was too busy to talk to them.

"Yes," he says to the silent salesman. "I'll write to Brown & Co. Their engines evidently embody some great improvements, and they are enterprising enough, and sure enough about them, to advertise them."

JOHN JONES & CO., **Somewhere, U. S.** **CORLISS ENGINES.**

Are you Jones, Smith or Brown?

Next time your trade paper comes along, look at your ad.

Is it really a proper and strong presentation of the selling points of your article?

Is it distinctive?

Is it attractive?

Is it interesting?

Is it informative?

Is it enthusiastic?

Is it convincing?

Does it contain just the straightforward, sincere argument you would bring to bear on a prospective buyer, if you were canvassing him personally?

If your ad. is weak in any of these particulars, it ought to be changed.

Lord ads. comply with these requirements.

THE COMPARATIVE VALUE OF TRADE PAPERS.

We have said that a good trade paper is a competent salesman.

From the advertiser's standpoint, what is a good trade paper?

The only measure of value in advertising is **results.** They may be direct or indirect, but results should be had commensurate with the amount spent.

A trade paper that sells your goods cheaply, is a cheap medium for you, regardless of its rates, circulation, or its editorial policy.

A trade paper that sells you twelve pages of space "for a song," and throws in twelve column "write-ups," but fails to sell your goods, is dear at any price.

The first pertinent question regarding any trade paper is: how many prospective buyers will this silent salesman reach?

The second question is: how will this silent salesman be received by these prospective buyers?

Will he get an audience?

Is his appearance for or against him?

Have they invited him to call by buying a year's subscription?

These questions relate to quality of circulation, and determine the influence of a trade paper.

As to appearance, it should be of convenient size and shape, well printed on good paper.

You, as an advertiser, are impressed favorably or otherwise by the appearance of a medium.

This is equally true of the reader.

PLANNING AN ADVERTISING CAMPAIGN.

The first step is to decide just what you want to accomplish. Advertising aimlessly is like walking in a field blindfold. If you have ever tried the latter you know that you walked in a circle and finally got right back to the starting point.

Perhaps you manufacture some small article, say an electrical appliance, and you want every electrician in the United States to try it.

Then a plan must be devised to accomplish this.

Or perhaps you have a new untried mechanical device of which the trade is skeptical.

Then you must conduct an educational campaign.

And so on.—C. F. Lord, International Correspondence Schools, Scranton.

Power and Transmission.

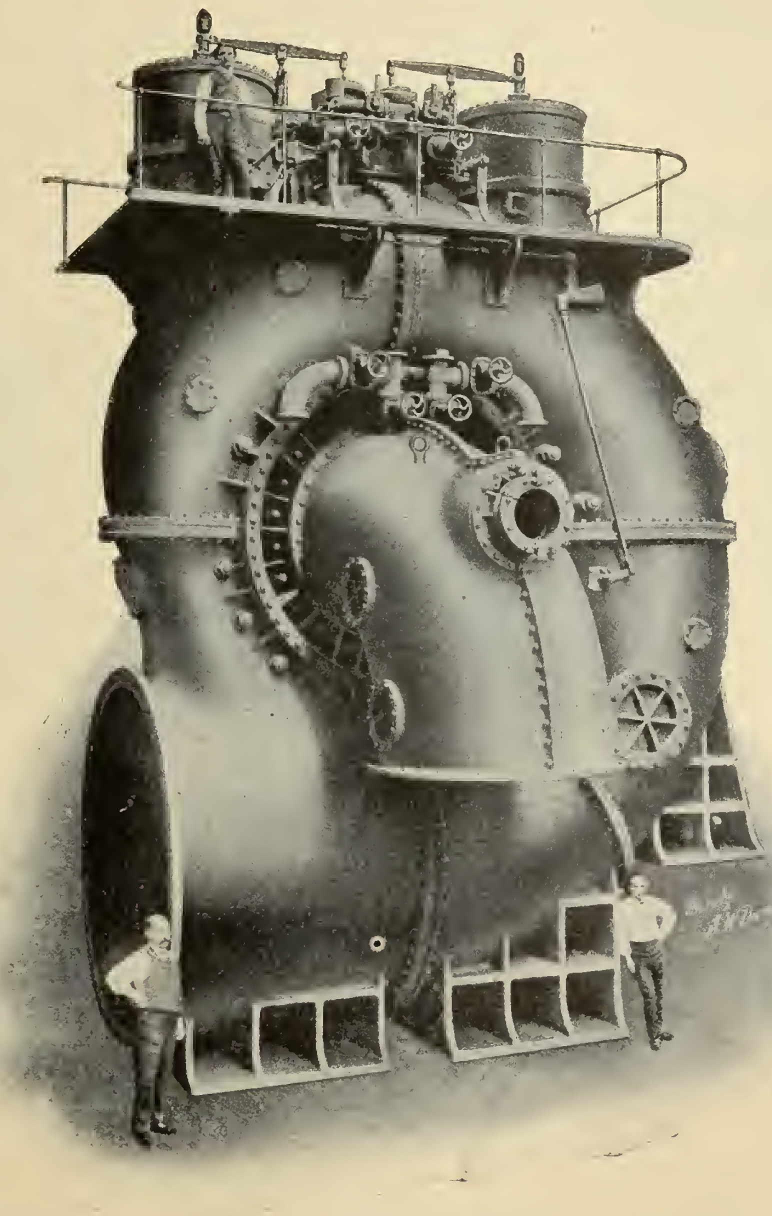
Steam. Gas. Electricity. Compressed Air. Water.

THE LARGEST WATER TURBINE IN EXISTENCE.

ONE of the most attractive of natural spectacles is the Shawinigan Falls on the St. Maurice River in Quebec, 84 miles from Montreal, where the river drops in beautiful cascades with a fall of 140 feet. During the past few years the name has come before the public in connection with its unique water power advantages, rather than the grandeur of its scenery, and the latest call for public attention is due to the fact that there is now being installed in the power house the largest water turbine ever built.

The capacity of the station is being enlarged by the addition of a fourth turbine. At present three penstocks are in position carrying water to as many turbine wheels in the power house on the shore of the lower lake. Each penstock supplies a 6,000 h. p. horizontal shaft turbine, direct connected to a 3,750 kilowatt revolving field generator, giving quarter phase 2,200 volt 30 cycle current. The wheels run at 180 revolutions per minute and provision is made for 2½% loss in the generators, and a 15% overload.

The new turbine built by the I. P. Morris Co., Philadelphia, has a capacity of 10,500 h.p., and its enormous size is well shown by the illustration. It is of the horizontal shaft inflow' type, with spiral casing and a draught tube in each side through which the water is discharged outward from the centre. The water enters the turbine through the intake 10 ft. in diameter at the bottom of the turbine.



10,500 H.P. Water Turbine, built by I. P. Morris, Philadelphia.

It flows around and fills the outer special tube and then passes it radially through an annular gate, and through the wheel, and diverging finally discharges right and left through two large draft bends, one on either side, of which one is shown in the illustration. In these bends are situated the bearings for the shaft, one of which is clearly visible in the view shown. It will be noticed that although the diameter of the intake is 10 feet at the bottom the sectional area gradually diminishes as the water passes around the tube, the diminution being proportionate to the amount of water that flows in through the wheel as its circumference is traversed.

The dimensions of this vast machine are as impressive as the illustration. It is 30 feet from the base to top; 22 feet wide over all, and 27 feet from centre to centre of the two shaft bearings. Its total weight is 364,000 pounds. The shaft which is of forged steel, is solid and weighs 10 tons. It is 32 feet 3½ inches long, 22 inches in diameter at the centre, and tapers to 16 inches on the generator side and 10 inches diameter on the other side. The runner or wheel, which is the rotating part of the turbine, is of bronze, and weighs 5 tons. The quantity of water used when the turbine is operating under full load is enormous, no less than 400,000 gallons passing through per minute. Just what this figure amounts to, will be understood when one knows that it equals a river 100 feet wide, 9 feet deep, and flowing at the rate of 60 feet per minute. In spite of its size, this huge

machine was built in no less than five months, the contract being signed May 19, 1904, and the photograph taken Oct. 2nd, the same year.

The present output of power from the Shawinigan station is 22,500 horsepower, and of this about 10,000 horsepower is transmitted 84 miles over long-distance lines to the city of Montreal, where it is used for street railway, electric lighting and general power purposes. The remainder is taken by local users for similar purposes and for electrolytic processes. The current is stepped up at Shawinigan from 2,200 volt quarter- phase, to 50,000 volt three-phase. The transformers were so designed that they may, if desired, be operated at 56,000 volts pressure. Although the turbine illustrated is the largest ever built, the same company is at present designing and building four turbines of yet larger power (13,000 h.p.) for the Electrical Development Co., of Ontario, Limited.

A NEW CONVEYOR-ELEVATOR.

IN connection with almost every industrial enterprise a considerable portion of the expenses is incurred in connection with the unloading, conveying and storing of the raw materials. These expenses become particularly heavy, where the conveying is to be effected for a considerable distance, or where difficult local conditions have to be overcome.

The efforts of every able manager of course are directed towards reducing these charges as far as practicable. In order to meet this want a large variety of conveyors, elevators, etc., have been designed. With all their fitness these appliances nevertheless still possess a rather important defect, namely, their inability to run in more than one plane.

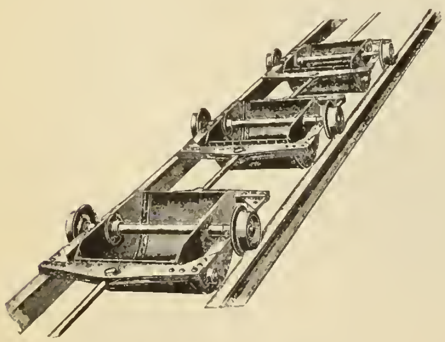


Fig. 1—Track showing Buckets

To overcome this difficulty the conveyor-elevator as shown in Fig. 1, has been designed, free from this defect, and yet combining all the advantages that are fairly claimed by others.

The construction is exceedingly simple and appropriate. The conveyor chain consists of a number of single axle frames, linked to each other, which run on rails, and on which the buckets are suspended in such a manner that they can swing freely as may be seen from the illustration (Fig. 1.).

The linked couplings of the frame impart great flexibility to the entire strand of buckets, rendering it possible to pass around a horizontal curve, as shown in Fig. 2.

The ability of the new conveyor to pass around curves of every description, is of the very highest importance, as it renders it possible to transport materials from any desired spot, around corners, etc., to any other spot without dumping and jolting.

At the same time the power required in operating such a conveyor is exceedingly low because the buckets in themselves are lightly yet strongly built and because rolling friction only is to be overcome. The rolls on which the buckets run are provided with a very effective lubricator.

Fig. 2—Frame with Curve.

The speed this conveyor is capable of running, is far beyond the speed customary and obtainable in similar conveyor systems.

The loading of the buckets is effected by a loader. Its construction varies according to the nature of the material to be handled. The unloading can be done by a tripper, which may be movable and placed anywhere desired.

Fig. 3, shows the conveyor in connection with an automatic weighing machine. The weighing takes place while the conveyor is in motion, the net weights of the material and the buckets are consecutively registered and summed up, so that the total of the weight that has passed over the weighing machine may be read off at any time at the indicator.

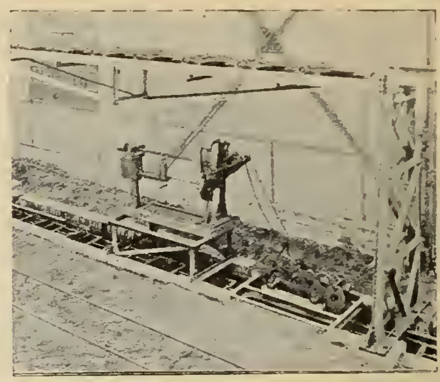


Fig. 3—Conveyor with Automatic Weighing Machine.

The principle upon which the weighing machine is constructed is that of weighing a given length of the conveyor at intervals of time corresponding to the travel of such length and automatically recording the weight. Thus if the machine is made to weigh six feet of conveyor, it will weigh and record every time six feet has passed, and so every portion of the conveyor will be weighed successively.

PARALLELING THE LARGEST TURBO-ALTERNATOR IN SERVICE.

IN the latter part of December, 1904, a 5,500-kw., 25-cycle, turbo-generator built by the Electric Company was put in operation in the Seventy-fourth street station of the Interborough Rapid Transit Company, New York. It was the first Westinghouse unit of this size to be put in service, although a number of similar machines are approaching completion. The next day, after this machine was put in service, it carried loads as high as 8,000 kw., and for considerable periods loads between 7,000 and 8,000 kw., were of common occurrence. This turbo-generator is the largest now in service.

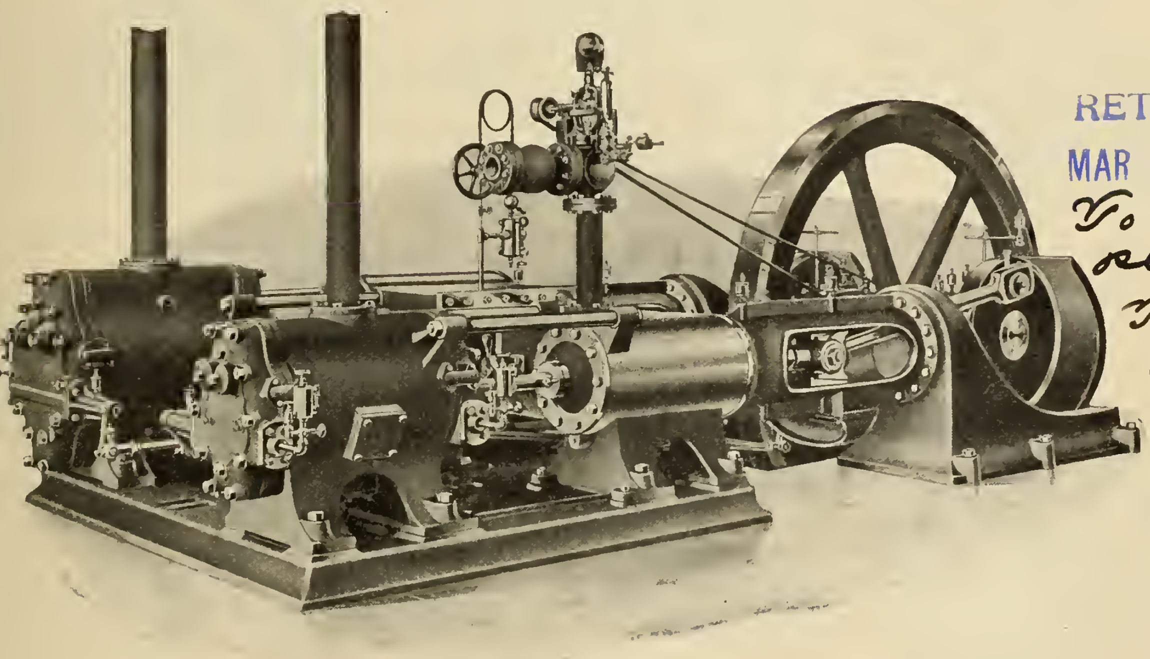
Within a few days after the machine was put in service, and while operating in parallel with six of the slow speed, 5,000 kw. machines in the same station, a short circuit occurred among the main leads at a point between the turbo-generator and the switchboard. This was a dead short circuit, and it tripped the automatic switches on all the slow speed machines which were set at almost three times full load current, but did not trip the safety switches of the turbo-generator on account of the fact that the arc was so violent that it burned off

the leads to the safety devices for this particular machine, though these leads were in a separate conduit. It was necessary to cut the turbo circuits off by hand, and the short circuit therefore continued on this machine some little time before it was cut out. Careful examination of the generator showed that it was absolutely uninjured in any way, as far as could be determined, and was ready for service immediately afterwards, but could not be thrown in with the other machines on account of the main leads to the switchboard being burned off. The machine has been in service with heavy loads since these leads were replaced.

The 5.500-kw. turbo-generator is run in parallel with the other machines in the station and the only notable difference in its operation and that of the slow-speed machines is due to the difference in the speed regulations of the two types of engine. The steam turbine was adjusted so that it regulated much more closely in speed than the low-speed engines and, in consequence, the turbo-generator takes the fluctuations in load. It is noted that when the turbo-generator is operating in parallel with the low-speed machines, that the latter machines carry a much steadier load than when the steam turbine is cut out, the turbine unit appearing to take all the fluctuations when it is in circuit. This unit, therefore, has something of the effect of a fly-wheel or a storage battery on the system. This effect, if considered undesirable, can be modified readily by adjusting the speed characteristics of the steam turbine.

On account of its uniform rotative velocity and its relatively large fly-wheel capacity, the turbo-generator is particularly suitable for operating rotary converter systems such as the Interborough. Such machines also operate extremely well in parallel, and the operation of a steam-turbine unit with a reciprocating unit is, in general, considerably better than reciprocating units with each other, due to the fact that the mean rotative velocity of the combined units is better than in the case of reciprocating units alone. In the case of the Interborough slow-speed generators, this effect is not noticeable, as there is no evidence of periodic speed fluctuations in the slow-speed units, due to a large extent, to the heavy dampers on the machines, their large fly-wheel capacity, and the proportions of the engines which are designed for very small angular variation.

Some months ago a series of tests was made to determine the paralleling qualities of turbo-generator units. At full voltage the machines ran perfectly in parallel. Fluctuations in speed were so slight that periods from one to fifteen seconds could be obtained for synchronizing. When the voltage was reduced to 60 per cent. of the normal, the machines would carry the full current without any evidence of hunting. The voltage was further reduced and tests were made, until about 15 per cent. of the rated voltage was obtained. Under these conditions the machines still remained in parallel when carrying full-load current, but the conditions of paralleling were not perfectly stable, the load being transferred from one machine to the other at an irregular but not rapid rate. As the synchronizing power varies approximately as the square of the voltage, it was extremely low in the last test cited. It is evident, therefore, that but small interaction is required between such machines to maintain parallel operation.—Electric Club Journal.



New Franklin Air Compressor.

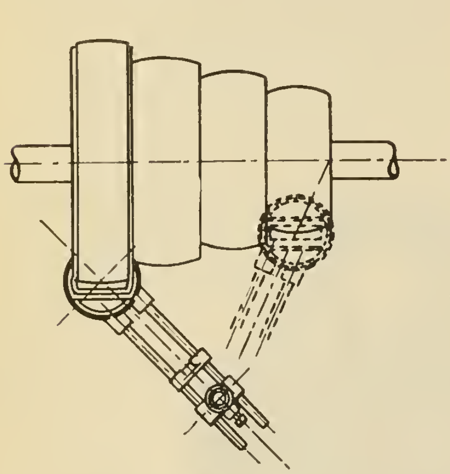
A NEW FRANKLIN AIR COMPRESSOR.

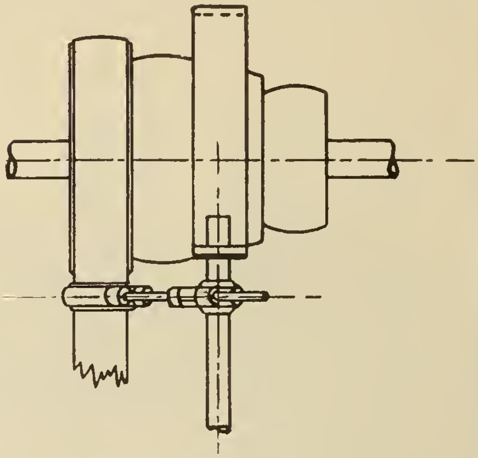
ONE of the air compressors recently furnished the Pennsylvania R. R. for their new shops at Altoona, Pa., is shown in illustration. They were designed and built by the Chicago Pneumatic Tool Company, at their compressor plant, Franklin, Pa., and belong to what they designate as their C.S.C. class of machines, having compound steam cylinders and compound air cylinders. They are designed to run non-condensing with a boiler pressure of 100 lbs. The high and low pressure steam cylinders are 11 inches and 20 inches in diameter respectively, and air cylinders 11 inches and 18 inches with a stroke of 24 inches. Capacity of each

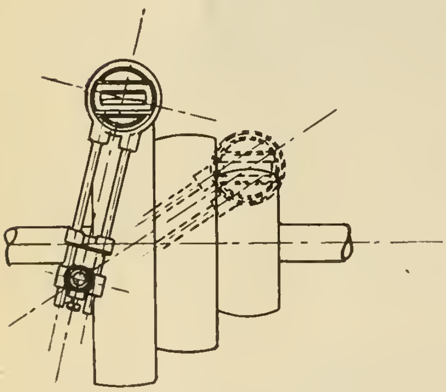
compressor is 700 cubic feet of free air at a speed of 100 r.p.m.

A glance at the illustration will show that, while graceful in outline, the machine is at the same time massive and compact. All bearings are of unusually generous proportions, pressure per square inch being so reduced as to avoid any tendency to heating, a fact which will be appreciated by those who have had much experience with the average air compressor. Bearings throughout are provided with removable shells or bronze bushings with simple but effective provision for taking up wear.

Steam cylinders are provided with Meyer adjustible cut-off valves. Main steam valves are double ported ad-







New Belt Shifter.

mitting of short ports and consequent reduction of clearance. High and low pressure main steam valves are efficiently balanced, reducing friction and wear to a minimum.

Both air cylinders are provided with mechanically-operated inlet valves of the Corliss type, which are placed in cylinder heads admitting of close clearance and large port area with consequent free admission of air. These valves are actuated by the steam cut-off eccentrics, so that four eccentrics drive both steam and air valves, the valve gear being very simple for the work performed.

The discharge valves are of the poppet type, valves proper being of cup shape, pressed out of sheet steel. The valve seats and guides are removable and readily accessible for inspection or renewal.

An intercooler, not shown in the illustration, is provided between high and low pressure air cylinders, which cools air after compression in low pressure cylinder down to the temperature of the atmosphere. This intercooler being self-contained can be placed in any location desired.

Owing to the small bore of cylinders and proportionately long stroke, the percentage of clearance in air and steam cylinders is very small, resulting in high volumetric efficiency and economizing of steam. The water jacketing also is much more efficient than in the compressors of ordinary proportions, having diameters of cylinders about the same as length of stroke. Provision is made for catching all drip from stuffing boxes and bearings.

Governor is furnished with a pressure regulator which brings the machine to a stop when receiver pressure has reached a desired amount, starting it again automatically upon a slight drop in receiver pressure.

It has been the aim of the manufacturers in bringing out these machines to furnish the trade with a compressor which would be the acme of perfection among machines of their class, and none of the refinements known to the art have been omitted in their design or manufacture. Further information may be obtained from the Chicago Pneumatic Tool Company, Fisher Building, Chicago, or 95 Liberty street, New York.

NEW BELT SHIFTER.

ALTHOUGH the number of machine tools driven by their own electric motors is increasing daily, and supplanting those with countershaft and driven from the main line shaft, there are still quite a number of machine shops where the old method of step pulley counters is still in vogue.

To facilitate the shifting of the belt and avoid the danger from using a long pole to shift the belt from step to step, especially where the countershaft is placed high above the machine, the belt shifter, illustrated herewith, is used with good success.

It consists of an upright shaft placed within easy reach of the operator, provided with a handle to turn it in either direction. The shaft is suitably carried by boxes and next to the cone pulley is fastened an arm terminating in a ring casting, in which an eyelet, through which the belt passes, is fitted, adjusting itself in line of belt drive.

The operation of the shifter can easily be followed on the accompanying sketches.

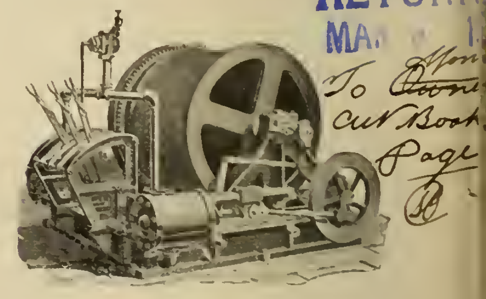
LARGEST GAS-ENGINE-DRIVEN GENERATOR IN THE WORLD.

THE contract has just been given to the Crocker Wheeler Company, for three 4,000-h.p. three phase revolving field alternatives, to be driven by 6,000 h.p. gas engines to be built by the Snow Steam Pump Works.

The Snow gas engines to which they will be direct-connected, are the largest in the world for this class of service. They will run at 83 r.p.m., and the generators will deliver 13,200 volts at 25 cycles. The installation of these three engine-driven generating units in San Francisco will mark an important step for the transmission company, as they will operate in parallel with the water power plants of the company, and thus serve as an important reserve plant for the entire system. One of the units will be used exclusively for handling the peak load on the railway lines.

TWO ALLIS-CHALMERS-BULLOCK SPECIALTIES.

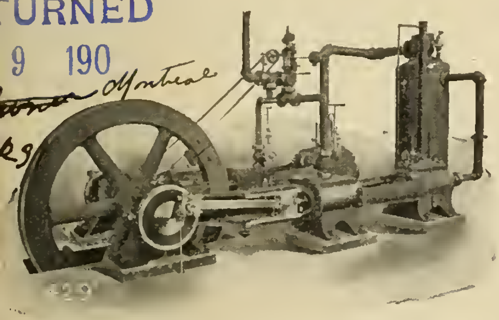
THE Ingersoll-Sergeant duplex compound steam driven air compressor, illustrated, is built in a variety of sizes, to meet a wide range of steam and air pressures. It is equipped



Lidgerwood Mine Hoist.

with an air ball governor which automatically controls the speed of the machine in direct proportion to the volume of air required. This control is so complete that the machine is frequently

brought to a standstill and then automatically resumes a speed sufficient to take care of whatever air consumption is thrown out. A brass tube intercooler is used between the high and low pressure air cylinders, and effects a large saving in the power required to compress the air. This compresser represents one of the best types, and is largely used for industrial purposes, as well as for mining work. A typical installation is that in the new Angus shops of the Canadian Pacific Railway Montreal. It consists of two machines each of 250 h.p. delivering 2,000 cubic feet of air per minute.



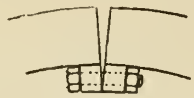
Ingersoll Sergeant Duplex Steam Driven Compound Air Compressor.

The hoisting engine illustrated, is of the well-known Lidgerwood type, and a large number have been sent to the mining districts of Canada. Its reliability and strength are the most marked characteristics. Seven hoists of 75 h.p. each similar to that illustrated, are used for hoisting and hauling in the mines of the Crow's Nest Pass Coal Co., at Fernie, B.C., In addition to the machines illustrated, Allis-Chalmers-Bullock, Limited, Montreal, manufacture all that is necessary for complete mine and power installations. The different machinery is fully described in the catalogues which the company issues.

WHY FLY WHEELS BURST.

THIS question is treated of editorially in Pages Weekly, and a simple explanation of the operation of a fly wheel in bursting is given. If proper methods were observed, accidents resulting from this cause would be less frequent. The tension upon the rim of a revolving wheel augments as the square of the velocity—that is to say, supposing for the moment that we had a wheel with a rim a foot square, revolving at the rate of 100 feet per second—the material being cast iron—the total resolved forces tending to tear the rim asunder would be, say 144,000 pounds. Now imagine this velocity to be increased by the failure of the governor to act, or otherwise, to 150 feet per second, or one and a half times as fast as before—a perfectly possible case—and we have 324,000 pounds to deal with. Double the original speed, and we have 576,000 pounds.

Just one more fact about our hypothetical wheel before we turn these figures



to account. Supposing the wheel to break up under the stress due to the last-named speed—200 feet per second—there is energy resident in that rim sufficient to project any part of it which might happen to be discharged vertically 600 feet into the air. This will give some idea of the potential force lying dormant in a flywheel. A well-known American writer who has made this subject his specialty, thus records his opinion: "A flywheel is just as dangerous as a boiler, and should be subject to inspection in like manner. The time to investigate a flywheel is during its lifetime, and the one to investigate it is a trained inspector, who can pronounce intelligently on its safety, or condemn it if dangerous."

The bursting speed of a solid cast-iron rim—i.e., without joints and free from contraction stresses, is about 425 feet per second. If the rim be built up of several parts, the sectional area at the joints may be reduced by recessing for dowels or cramps, to an extent which at once lessens its ultimate strength by one-half.

Wheels with deep rims should never be joined by internal flanges and bolts; certrifugal force tends to open the joint and bring a leverage to bear upon the bolts which may be as much as four to one, compared with the same bolts in direct tension.

In the case of thin-rimmed wheels, as rope or belt pulleys, for example, where internal flanges are almost a necessity, this leverage is not nearly so pronounced, but still it exists, and should be taken into account.

Each rim-section of a wheel, built up of segments with the joints midway between the arms, is in the condition of a beam supported at the ends, and uniformly stressed. The maximum bending moment occurs, of course, at the centre of the beam, and consequently the joint is in the least favorable position possible. It should be either at the arm or as near to it as practicable.

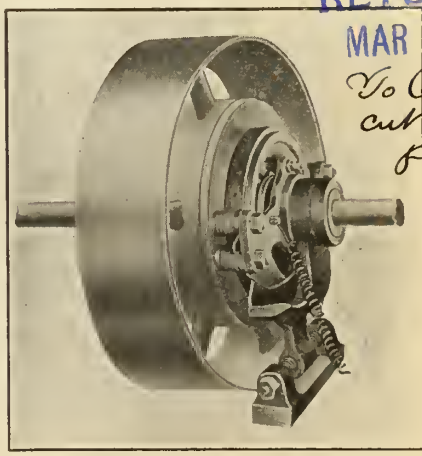
ELECTRIC CLUTCH.

ONE of the latest entries into the field of electrically-operated machinery is the Williams electric clutch, a cut of which is shown herewith. The driving principle of the clutch consists in the clamping of a number of discs by magnetic action. The multipled discs brought in intimate contact by their magnetization gives these clutches great driving power, as compared with their size and the consumption of current in the energizing coil, is so small as to be negligible. A 50h.p., 100-r.p.m. clutch requires approximately 1-2 amp. at 110 volts.

The actuating coil is mounted concentrically with the shaft bore of the clutch and is enclosed in an oil and water-proof metallic case. This in turn is enclosed in the clutch proper which saves it from damage from external sources. This coil is insulated in accordance with the best electrical practice, being given a break-down test of 2,200 volts alternating current for 110 and 220 volt work and 5,000 volts alternating current for 500 volt service.

In these clutches the objectionable residual magnetism causing the clutch to hold for a short period after the current has been cut off, has been entirely overcome, and they will take hold and let go more promptly than any mechanical clutch can.

Two types are built; those in which the current is left on while the clutch is in operation, and those in which the current is only used to throw the clutch on and off. The same principle



Electric Clutch.

is also made use of in a safety device for stopping heavy tools or machines in case of accident to the operator. The pressing of a button of the least pressure on a safety cord enables the heaviest machinery to be brought to practically an instantaneous standstill in case of a workman being caught, and at the same time indicates through an annunciator in the superintendent's or manager's office the machine or section of factory effected. This apparatus is being placed on the market by the Williams Electric Machine Company, of Akron Ohio.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

Arrangements are under way to endeavor to open a stove foundry at Moose Jaw.

Clark & Demill, Galt, are moving their machinery to their new factory at Hespeler.

A three-foot coal seam has been opened up two miles north of Swift Current, Assiniboia.

A new electric line is proposed to be erected between St. Jerome and Lake Achigan, Quebec.

The C.P.R. are said to be negotiating for the purchase of 60,000 tons of steel rails in Great Britain.

The Levy, Weston & McLean Machinery Co. have just shipped a carload of machinery to New Liskeard, Ont.

The Standard Windmill and Manufacturing Company of Michigan are arranging to establish a factory at Whitby.

The ratepayers of Calgary have decided in favor of installing a municipal electric lighting system in the town.

The Alvinston Power Company, Limited, is extending its circuits to provide for about 300 more private lights.

A stump-pulling machine factory may be located in Ottawa as a branch of an industry at Black River Falls, Wisconsin.

Bids will be received February 15 by S. O. Perry, city treasurer, St. Thomas, Ont., for $200,000 gas and electric light bonds.

The net earnings of the Halifax Electric Railway for 1904 were $137,523, or equal to 10.18 per cent. on the capital stock.

A company has been incorporated to build a railway from Spokane to the international boundary to connect with the C.P.R.

It is proposed to extend the radial railway system of Toronto considerably, and plans are now under way with that in view.

J. M. Ross & Co., St. Catharines, have settled their differences with that city over the payment of a bonus of $20,000.

It is proposed to install at the city electric plant two direct-connected units of 800 kilowatts capacity each, in Campbellford, Ont.

The Niagara Falls Foundry and Machine Company has paid a dividend of 6 per cent. for the seven months since its reorganization.

The C.P.R. has let the contract for double tracking the railroad from Fort William to Winnipeg. The work will cost $7,000,000.

Petrolia Electric Light, Heat & Power Company is installing a new street lighting system of alternating-current series enclosed arc lamps.

The Oshawa Electric Light Company is extending its street lighting circuits and also arranging to increase its service to private consumers.

It is proposed to substitute alternating-current series arc lamps for the direct-current lamps now used for lighting the streets of Thorold.

It is rumored that Mr. Whitney, ehe owner of the copper smelting plant at Pictou, has sold the property to a syndicate of American capitalists.

The Hamilton and Barton Electric Railway Company did not declare any dividend for 1904, about $12,000 being spent in improving the property.

Two more carloads of ore have been shipped from Cobalt, in the Nipissing district, to New York. The last shipment of 20 tons assayed $28,000.

A new mill is to be erected on the Fraser River at New Westminster, B.C. The company operating the mill is to be known as the Small & Bucklin Co.

Petroleum and coal have been discovered near Chambord Junction, Quebec. Both the class of coal and petroleum found are said to be of the first order.

The Canadian Meter Company is moving from Windsor to Hamilton. They will manufacture gas and other meters in the old Evans mill on Caroline street.

Japan bought goods worth $249,500 from Canada last year, $9,137 less than the preceding year. Canada's importations from Japan showed a decline of $281,130.

A new engine room is being built at the municipal electric light plant, Strathroy, Ont., and upon its completion a new engine and condenser will be installed.

It is probable that a syndicate of Minnesota lumbermen will complete arrangements within a few weeks for the building of a large sawmill plant in Vancouver.

The Ottawa Electric Railway Company's net earnings in 1904 were $139,097.70. Dividends of 8 per cent. were declared and $9,999 was paid to the city as mileage.

English and Canadian capitalists are interested in the project of erecting a large sawmill to supply the foreign market, and a large iron works at Esquimalt, B.C.

The latest sensation in the Kootenays is the finding of ore giving values ranging from 160 to 240 ounces silver and from $10 to $60 per ton gold, with three per cent. copper.

A branch factory of the Henderson Roller Bearing Company will be established in Winnipeg. R. I. Henderson, manager of the company, says 60 men will be employed.

The Canadian Copper Company of New York, owning 300 acres of mining lands in the Thunder Bay district, are suing two Chicago capitalists for $75,000 for breach of contract.

Sufficient orders have now been received by the Locomotive and Machine Company of Montreal, to keep its workshops at Longue Pointe in full blast until next September.

The Canadian Barcalo Mfg. Co., Welland, has commenced manufacturing brass and iron bedsteads and bed springs in the factory recently vacated by the Frost Wire Fence Company.

The Londonderry Iron Company and the Nova Scotia Steel and Coal Co., are both prospecting the iron district at Torbrook and Nictuax, N.S. Both have taken extensive options.

A notification has been received by the Backus-Brooks Lumber Company, of Minneapolis, from the Dominion Government, granting permission to construct an immense dam at Fort Francis.

The Customs revenue of Canada for the seven months ending Jan. 31, totals $24,208,967; an increase of $580,462 over the corresponding months of 1904. The gain in January alone was $30,106.

An electric railway is about to be built from Windsor, Ont., through Leamington and Kingsville, to Chatham, and will be known as the "Windsor, Essex and Lake Shore Rapid Railway Co."

A company has been organized to put up a wood-working factory and will proceed with its erection at once if the town of Dalhousie, N.B., will exempt them from taxation and give free water.

The Betz Manufacturing Company, Hamilton, Ohio, are negotiating regarding the establishment of a branch factory at Hamilton Ontario. They make laundry machinery and paper mill specialties.

No. 2 blast furnace, at the Dominion Iron and Steel Works, Sydney, N. S., produced an average of 300 tons of pig iron daily last month. This is more than both No. 1 and No. 2 furnished in January, 1904.

It is stated that the Mackenzie & Mann Company, and some other interests, are considering the question of erecting in the near future a smelter at Port Arthur with a daily capacity of from 150 to 200 tons.

The Provincial Secretary for Ontario has, by a license, authorized the Madoc Mining Company of the State of New Jersey, to carry on business in Ontario under the name of the American Madoc Mining Co.

The coal shipments of Nova Scotia this year amount to a total of 4,367,000 tons. This amount is from six collieries. Unless the others produce among them 325,000 tons, the yield of 1904 will be lower than that of 1903.

An important mining deal has gone through at Salmo, South Nelson, B.C., whereby the Kootenay Bell group of mineral claims has been bonded by Patrick Clark, the millionaire mining operator of Spokane, for a hundred thousand dollars.

10,901 tons of silver-lead ore and 2,239 tons of zinc ore have been shipped from the mines in the Slocan district, B.C., during the year 1904. During the year the Slocan Star paid a dividend of $50,000, and the Sunset distributed $12,000.

An agreement has been reached by which the Vancouver and Lulu Island Railway has been transferred to the British Columbia Electric Railway Co., and work will be commenced immediately to convert the road into an electric system.

The Redding Mining Company is installing machinery for a stamp mill at the company's mine in the Atikokan district near Fort William. Mr. Dalphin, Montreal, has charge of the work and

the stamp mill will be in working order before next Fall.

The Penden Nail Works Company, St. John, N.B., are erecting a new mill. Each $100 share in the company has paid $240 in dividends in twelve years and, while only $77,000 of the capital stock was paid up, there is a surplus of $97,000 in the bank.

The tonnage of ore shipped from the several mines for the week and the total for year: Le Roi, 2,490; Central Star, 1,560; War Eagle, 1,050; Le Roi No. 2, 550; Spitzee, 130; Jumbo, 216; White Bear (milled), 30; total for week, 6,026; for the year, 342,325.

The audit office at Ottawa has received claims from the Algoma Steel Compant, Sault Ste. Marie, for bounty on pig iron amounting to $19,540. This is for two months ending December 15. During this period about 13,000 tons of pig iron were produced.

The annual meeting of the Sherbrooke, Que., Power, Light and Heat Company was held on Jan. 23, and Mr. Justice White was re-elected president, the old board of directors being also re-elected. A dividend of 2 per cent. was declared for the current six months.

Last year, out of 1,450,000 tons of coal brought into the St. Lawrence, 47,000 tons came from Great Britain. The preceding year for a number of reasons, the imported coal was in far greater proportion, namely, 134,000 tons out of a total of 1,243,000 tons.

W. F. Forrest, Atwood, who is erecting a new grist mill near his planing mill in that town, will equip the new mill with sufficient boilers and machinery to do a general milling business and supply electric light for the town. The building and plant will cost about $11,000.

McLennan Timber Lands and Lumber Company, Limited, Quebec, share capital, $50,000; to manufacture and sell lumber. The directors are: John McLennan, Syracuse, N.Y.; A. J. Price, Notre Dame de Quebec, C. E. Taschereau, L. A. Taschereau, and F. Roy, all of Quebec.

The record made by the Rossland mines during the past year was a good one, the total output being 342,324 tons, of a value of $4,400,051.58, which is considered to be an excellent showing. The total tonnage for the camp for 11 years since ore was first produced is 2,020,198.

The Battle Creek Health Food Company, whose factory at London was destroyed by fire three months ago, has rebuilt the factory and installed a new lot of machinery, including cleaning and dusting machines, large five-ton rollers, scouring machines, traveling ovens, soaking tanks, etc.

In England during 1904 the output of iron ore was 13,715,645 tons, which is an increase of 289,641 tons over the previous year, but the value, $16,149,685, is less by $290,820, than in 1903. The imports of iron ore during the year were 6,314,162 tons, 78 per cent. of which came from Spain.

The Simplex Railway Appliance Company, which already has had numerous very large orders, with the different Canadian railways, has started work on a plant below Montreal West, which will cover thirty acres of land, and besides turning out all kinds of appliances may also go into car building.

Application will be made to the Dominion Parliament at its coming session by the Niagara-Welland Power Company for an act authorizing the company to use its proposed canal for navigation purposes, to construct a tramway along its right of way, and to extend the time for the completion of its works.

Two large enterprises are proposed to be established at Esquimalt, B.C., if the British naval station is abolished. One plan is to establish a monster sawmill and a wharf capable of accommodating the largest vessels, while the other is to erect large iron works. Local and English capitalists are said to be interested.

The directors of the Rossland-Kootenay Mining Co., Limited, have issued their report and account for the year ending Aug 31st last. Owing to the difficulty of obtaining satisfactory rates from the smelters, the shipments of ore during the year were greatly restricted. The profit and loss account shows a credit balance of £8,898.

In the number of strikes and lockouts in Canada, 1904 showed a great improvement as compared with 1903, the total number of disputes in existence being only 103 as compared with 160 in 1903 and 123 in 1902. The number of workingmen involved in strikes during 1904 was 15,665, and the loss time in working days approximately, 278,956.

The Ross-McLaren saw mill, situated on the Fraser River, British Columbia, is to be put under operation after fifteen years of idleness. Before re-commencing operations, the mill will be entirely refitted with new machinery. The new company, which is known as the Fraser River Sawmills Co., intend manufacturing lumber for export trade only.

N. Thompson & Co., Vancouver, have purchased a portion of the Albion Iron Works Company's plant at Victoria, consisting of large steam rolls, a steel hammer and a number of smaller tools. Mr. Thompson states that the floating dock being constructed in Great Britain is nearing completion and the first section will reach Vancouver during 1905.

The output from the Nova Scotia mines in 1904 is estimated at 4,650,000 tons. An approximate estimate of the shipments by counties is: Cape Breton county, 3,250,000 tons; Inverness county 250,000 tons; Cumberland county, 600,000 tons; and Pictou county, 550,000 tons.

An industrial boom in New Westminster, B.C., and its vicinity, promises to be a feature of the present year. Mills that have been closed for ten and fifteen years are to be opened, re-fitted and run on a very extensive scale. Sites have been purchased for the erection of a tannery and several saw and grist mills.

Huff & Carter, well-known timbermen of Fort Saskatchewan, have been awarded the contract for the taking out of 100,000 ties for the Canadian Northern Railway during the Winter. These ties are to be used next season in the extension of the main line towards Edmonton. The contract calls for their delivery at Battleford by July 1, 1905.

A company of English capitalists propose erecting large cement works at Sydney, N.S. They are asking the city for a bonus of $10,000, free taxation for twenty years and special water rates, which concessions the city is prepared to grant. The company will begin operations in May. The plant will have capacity of five hundred barrels per day. There is to be a large cooperage in connection with the works. The cement will be manufactured from the slag, now the waste product of the Dominion Iron and Steel Company. The company is capitalized at $500,000.

Exclusive of corn and bullion, which amount to between $7,000,000 and $8,000,000 yearly, Canada's total imports from United States in the fiscal year 1904 amounted to $143,010,578, an increase of 11 per cent. over the imports of 1903. Of this total $65,466,798 worth was admitted free and $77,543,780 worth paid duty. Canada's exports to United States amounted to $66,856,885, a decrease of 1 1-3 per cent. as compared with the preceding year. Our exports to Great Britain show a much greater shrinkage, having fallen from $125,199,980 to $110,120,896, a decrease of 12 per cent.

The British Columbia Electric Railway Company, which has been operating electric systems of street railways in Victoria, Vancouver and New Westminster, and between the two last-named cities, has taken over the branch line of the C.P.R. between Vancouver and Steveston, and will operate it as an electric railway, establishing an electric sub-station at Eburne for the new line. Electrical energy will also be supplied to cannerymen and other manufacturers who will establish additional enterprises at Steveston and other points near the mouth of the Fraser River. The electric system will be installed about July 1.

The Canada Iron & Foundry Company, Limited, St. Thomas, Ont., has just moved into its new shops, which comprise a main foundry building 76 x 600 feet, a warehouse 40 x 130 feet, a shipping room 32 x 70 feet, besides a machine shop, power house and office building. The main building is divided into a car wheel molding shop, a general casting shop, a furnace room, cupola room and a machine shop. The firm manufactures chiefly railroad wheels and railroad castings. Its main offices are at Montreal and it has works at Hamilton as well as the new plant just completed at St. Thomas. J. A. Kilpatrick is manager of the St. Thomas plant.

The holders of the preferred stock of the United States Steel Corporation will this year receive in dividends a grand total of more than $25,000,000. This sum will be divided among about 43,000 shareholders. As a dividend payer the United States Steel Corporation is exceeded only by the Standard Oil Company, which this year paid $34,920,000 in dividends. Since it was organized in 1901 the Steel Corporation has paid a total of $172,458,000 in dividends to common and preferred stockholders. Since its organization the Standard Oil Company has paid $242,900,000 in dividends to stockholders. There are only 970,000 shares of Standard Oil stock, and there is understood to be less than 1,000 stockholders. There are more than 8,000,000 shares of common and preferred stock of the Steel Corporation and close to 100,000 shareholders.

There is a very active movement in freight at present on both the Grand Trunk and Canadian Pacific Railway lines. The rather mild weather that has prevailed during the Winter has

enabled the companies to keep their shipments right up to date. Last year at this time thousands of loaded cars were standing snowbound on country sidings.

With the Grand Trunk Pacific and Canadian Northern Railways purchasing steel rails, the outlook never appeared brighter. It is expected that the present output at the Soo will be inadequate to meet the demand. These prevailing conditions almost assure the success of the Dominion Iron and Steel Company's rail mill which is nearly completed.

The Grand Trunk Railway Company have placed an order for 25,000 tons of steel rails with the Dominion Iron and Steel Company, of Sydney, N.S. The Grand Trunk Pacific would need something like five hundred thousand tons of steel rails, and the order for the same would probably be divided between the "Soo" and the Dominion Iron and Steel Company.

From the monthly statements of pig iron produced this year, that for December being estimated somewhat larger than for November, the total will be about 16,100,000 tons. This compares with 18,009,250 tons in 1903; 17,821,305 tons in 1902; 15,878,354 tons in 1901, and 13,789,242 tons in 1900, the latter being the largest annual production up to that date.

The Boston Last Company are putting in five more last machines in their factory at Richmond, Que. The large saw for cutting the logs in required lengths has arrived, and is being put into position. The saw is 5 ft. 6 in. high, and will cut a 28-inch log. They expect to have the same in position in about ten days. The siding put in by the G.T.R. System is now completed.

Because of the refusal of the mining company to pay $15,426 claimed under the Act providing for a tax of 2 per cent. on all ore mined, the Government ordered the seizure of the Le Roi mine near Rossland. However, when the seizure was made the company immediately furnished a bond sufficient to cover the amount demanded and the deputy sheriff left the property.

The annual meeting of the Winnipeg Electric Street Railway Company took place on Jan. 25. The annual report was considered very satisfactory. The directors for the ensuing year elected were as follows: William Mackenzie, president; William Whyte, vice-president; F. Morton Morse, secretary-treasurer; Sir William Van Horne, D. D. Mann, A. M. Nanton and D. B. Hanna, directors.

Extensions, which are being made by the Great Northern Railway in the Province of British Columbia, are practically completed. The extension made on the line in the Crow's Nest Pass district has been completed, and trains are now traveling over the line, while the other extension from Grand Forks to Phoenix, although not quite completed, is expected to be in full operation in a few weeks.

A company is proposed to be incorporated at Sydney, C. B., to build a dry dock, acquire a 200-ton wrecking steamer, and establish steel shipbuilding works capable of turning out 15,000 tons annually. The name chosen for the undertaking is The Shipbuilding & Wrecking and Dry Dock Company, Limited. The city of Sydney has been asked to give a bonus of $250,000. Axel Johnson of Stockholm, and the Dominion Iron and Steel Co. are said to be behind the enterprise.

Brandon Developing, Mfg. and Supply Agency, Brandon, capital stock $40,000; purpose to manufacture and deal in all kinds of cement machines, steam and gasoline engines and business of general manufacturers. The directors are: H. Gutteridge and J. H. McConnell, both of Hamiota; R. J. McKay and A. Lynn, both of Killarney; D. A. Stewart, of Deloraine, and J. McLaren of Clearwater.

According to an estimate, the mineral production of Canada for 1904 will exceed that of last year by over $3,500,000. The increase took place in gold, silver, lead and coal. It is estimated that during 1904 there were mined 57,050 ozs. of placer gold, 256,135 ozs. of lode gold, 3,505,805 ozs. of silver, 36,688,580 lbs. of copper, 37,000,000 lbs. of lead, 1,668,000 tons of coal, and 277,400 tons of coke.

A newly-organized company is taking advantage of the offer of a bonus of two hundred and fifty thousand dollars offered by the city of Sydney, N.S., two years ago to any company which would start a ship-building industry in that city. Besides erecting a ship-building plant capable of turning out one 15,000-ton steamer every year, this company will build a floating dry dock which will hold an 8,000-ton vessel.

The organization of the New Brunswick Iron Co., St. John, N.B., has been completed. The following directors were elected: John S. McLennan, Sydney; C. W. Young, St. Stephen; A. D. Wetmore, Truro; L. B. Knight, St. John, C. V. Wetmore, Sydney. The directors met subsequently and elected the following officers: C. V. Wetmore, president; John McLennan, vice-president; Peter Clinch, secretary.

Anglia Land & Lumber Company, Limited, Winnipeg, share capital, $200,000; to acquire and sell lands with timber, to manufacture brick, to build and operate saw mills, and to build and sell houses, etc. The directors are: A. L. Himle, Minneapolis, Minn.; E. T. Thompson, St. Thomas, North Dakota; and Thomas G. Sharpe, G. Olafson, S. Sveinsson, John Horne, H. D. Bauer, C. Gilbertson and Helen Sanford, all of Winnipeg.

The completed rolling mills of Canada aggregate eighteen, of which one has a Bessemer steel plant, one a Tropenas steel plant, and five open hearth steel plants. The annual capacity of the blast furnaces is placed at 830,000 gross tons of pig iron; of the Bessemer and Tropenas steel plants, 200,800 tons; the open hearth steel plants 451,000 tons, while the total capacity in finished, rolled and forged products *is placed at 839,600 tons.

A Vancouver company has been incorporated for the manufacture of wire and wire nails. The president and managing director are at present on a trip through the United States looking up machinery. Contracts have been placed for a continuous supply of steel rods and other raw material to insure an output of from 50 to 200 tons per month at the start. No shares in this company are offered to the public, all the capital having been secured privately.

Mackenzie & Mann have contracted for the erection of a pig iron smelter on a site in the vicinity of Fort William and Port Arthur. The capacity will be about 200 tons of iron ore per day, the ore being mined in the neighborhood of Atikokan and Mattawan on the Canadian Northern Railway. It is estimated that the works will cost about $1,000,000 and after their completion, about October next, will employ about 1,000 men.

A Chinese capitalist is in British Columbia investigating the lumber industry, his intention being to establish large saw mills near Canton, China, the mills to be managed by Chinamen who have spent several years in British Columbia and have learned the lumbering business thoroughly. The Chinese lumber market will be supplied by the home-grown timber manufactured by Chinese cheap labor with the aid of American machinery, if the plan is adopted.

A new saw mill and sulphite plant will be erected at Swanson Bay, B. C. After the manufacture of pulp is well under way, it will be shipped to England. The saw mill will have a capacity of 40,000 feet per day and the sulphite plant will be capable of producing from 35 to 40 tons of sulphite pulp daily. It is the intention of the company—the Canadian Pacific Pulp and Paper Co.—to erect at no distant date, a paper mill in connection with the above plants.

Application will be made at the next session of the Ontario Government for the organization of the Algoma Copper Range Railway Company. It is the intention of the new company to build a mining road from Batchewanning Bay on Lake Superior to Aubrey Falls, a distance of seventy-five miles. This line will open up a great mining district in that section. A line of boats will also be operated by the company in connection with their other undertakings.

Receipts of Canada for the year ending June 30th last, on account of the consolidated fund, amounted to $70,669,816, and the expenditure of same amounted to $55,612,832, thereby showing a surplus of $15,056,894. The expenditure charged to capital was $7,881,718, railway subsidies received $2,046,878, and $1,130,041 was paid out on account of bounties. The net debt at the close of the fiscal year was $268,867,718, a reduction from the previous year of $739,270.

It is understood that the Dominion Iron and Steel Company has decided to adopt at its works at Sydney, Nova Scotia, a new and inexpensive process for the manufacture of pig iron, utilizing waste iron ore, which costs from 60 to 75 cents a ton. The plant which they propose to install will cost about $8,000, and will have a daily output of 75 tons. It will be the first of the kind erected on the continent, and the company will have the exclusive rights for the Dominion of Canada.

The total mineral products of Canada proper for the year were valued at $12,870,503, and the wages paid amounted to $4,222,386. Of the total value, $7,628,018 represents product of the non-metallic class and $5,242,575 metallic products. The total production of gold was 10,383 ounces, valued at $188,036; the industry gave employment to 493 persons, who were paid in wages $245,490. Including the cost of supplies, it required an expenditure of almost $2 to extract $1 worth of ore. The same story is told of silver mining; the total quantity produced was 16,688 ounces, valued at $8,949, and the wages paid out

$8,000. The production of lead was still more unprofitable, although restricted. The amount mined was 25 tons, valued at $1,500, at a cost of $5,189. Copper and nickel properties on the whole gave excellent returns. The value of the products was $3,215,794, and the wages paid aggregated $872,302, leaving a large margin for supplies.

A plant for manufacturing firebrick is to be erected shortly at Matsqui, B.C.

Estimates are being prepared for the erection of a new electric plant at Hull.

A by-law was passed by the council of Berlin, granting $22,000 for lighting purposes.

A. R. McDiarmid and J. Clark, both of Winnipeg, intend erecting a large modern planing mill.

A new saw mill with a capacity of 25,000 feet per day, is to be erected at La Vallee, Ont., at once.

The gross earnings of the Havana, Cuba, electric tramway in 1904 were $240,000 in excess of 1903.

Montreal Street Railway Company has decided to spend $500,000 on improving the system during the present year.

A new electric power house is to be erected in the vicinity of Sarnia tunnel in connection with the hauling of trains through the tunnel.

An export lumber mill with a daily capacity of 200,000 feet is to be built on the Clayoquot Sound, west coast of Vancouver Island.

Haines Bros., New York, have received the contract for building the road of the Hamilton, Ancaster and Brantford Electric Railway Company.

Meaford's town council has made an offer of $8,600 to W. Moore & Sons, proprietors of the electric light plant in that town. The offer was refused.

Kingston Locomotive Company, Kingston, have received the contract for the construction of four engines for the Temiskaming and Northern Ontario Railway.

A contract has been awarded by the Toronto Railway Company, for the installation of a new storage battery in their power house, which will cost $10,000.

It is rumored that R. Robertson and J. A. McMillan, of Nelson, B.C., and C. J. Clayton, of Victoria, purpose erecting a large steel industry in the vicinity of Nelson.

Work on the construction of the Vancouver Portland Cement Co., Victoria, is being rushed forward very quickly. It is estimated that the machinery will be installed very shortly.

The Montreal branch of the Canadian General Electric Company have received the contract for the erection of a turbine power plant for the Canada Car Company. This plant is the first of its kind in Canada.

A. Mowry, a machinist of Moncton, N.B., recently succeeded in perfecting a new kind of nut lock upon which he secured patents in England, United States and Canada. His rights have been purchased for $14,500.

A large zinc smelter in connection with the Crow's Nest Pass will be erected at Frank, B.C. The new plant will be the largest of its kind in Canada, and will be able, beside treating ores for zinc, to treat for silver and lead.

Two cars of mining machinery for the Granby Mines, Phoenix, B.C., have been received recently. They comprise a giant ore crusher with capacity of 1,500 tons for one shift. The monthly pay roll of the Granby Mines at Phoenix is now nearly $50,000.

The Redding Mining Company is installing machinery for a stamp mill at the company's mine in the Atikokan district near Fort William. Mr. Dalphin, Montreal, has charge of the work and the stamp mill will be in working order before next Fall.

A rumor is current to the effect that the Ottawa Electric, Consumers' Electric, Hull Electric, Hull and Ottawa Power Companies, and Capital Company, Deschenes, Que., are about to amalgamate with a joint capital approaching $10,000,000.

The annual meeting of the Sherbrooke, Que., Power, Light and Heat Company was held on Jan. 23, and Mr. Justice White was re-elected president, the old board of directors being also re-elected. A dividend of 2 per cent. was declared for the current six months.

The Battle Creek Health Food Company, whose factory at London was destroyed by fire three months ago, has rebuilt the factory and installed a new lot of machinery, including cleaning and dusting machines, large five-ton rollers, scouring machines, traveling ovens, soaking tanks, etc.

N. Thompson & Co., Vancouver, have purchased a portion of the Albion Iron Works Company's plant at Victoria, consisting of large steam rolls, a steel hammer and a number of smaller tools. Mr. Thompson states that the floating dock being constructed in Great Britain is nearing completion and the first section will reach Vancouver during 1905.

The Molsons Bank, creditor for $23,830, is asking for the winding up of the Eager & Sanderson Company, of Winchester, flour and feed dealers and owners of an electric light plant. The liabilities total $25,830, with the assets estimated at $15,000. An arrangement may be made whereby Winchester will still be lighted, undisturbed by the litigation.

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The steel rail industry of the United States is very active at present. The New York Central road has placed an order for 12,000 tons and the Delaware, Lackawanna and Western road has placed an order for 6,000 tons. Some orders calling for 5,000 and 8,000 tons have been received by the Pittsburg plants from bridge constructing firms in Cincinnati, while an order for 14,000 tons for bridge work for the Harriman lines is still pending. Numerous inquiries have been received from Mexico and business of a large order is expected to be transacted very shortly. The United States Steel Corporation have now on their books 425,000 tons of rails for next year's delivery.

Many of the leading shippers in the mining district of British Columbia are increasing their plants. New machinery to the value of over half a million dollars has been ordered and will be installed during the next few months in a number of mines in the Rossland and Slocan districts. The Velvet mine at Rossland is putting in new concentrators and stamps that will cost $45,000. At the Cliffe mine in Rossland about $30,000 is to be expended in a thirty-stamp mill to increase the output. $12,000 is being expended by the Spitzee mine at Rossland in compressors and machine drills, while a new tramway is being put in at the Jumbo mine which will greatly facilitate the shipment of ore.

The new electric lighting system which is owned and controlled by the city of Moose Jaw, Assiniboia, is now in effective operation. The electrical apparatus including the generator, switchboard, pole line and wiring system, was supplied by Allis-Chalmers-Bullock, Limited, Montreal. The generator is a 2-phase 2200-volt 100-K.W. Bullock revolving field type. The power house is equipped with a tandem compounding condensing engine of 160 h.p., built by the Robb Engineering Company of Amherst, N.S. When the pumps are installed the cost of the building and machinery will be in the neighborhood of thirty-eight thousand dollars. The whole equipment is thoroughly efficient and modern.

The new blast furnace, coke and roasting ovens and pig iron smelter, which Mackenzie & Mann propose to establish at Port Arthur to treat the ores from the mines at Atikokan, will probably be located on a site just south of the McIntyre River. It is now announced that the railway company has closed a contract for the location by the Pittsburg Coal Company of immense ore docks on the north side of the river. This company has been

looking for a site for over a year upon which to erect docks. It is said the docks will be of a size sufficient for the purposes of the railway and the coal company's own trade. The docks will be the most modern on the lakes and will employ several hundred men during the season of navigation.

Production of coal and coke in the Crow's Nest Pass collieries for the year 1904 was higher than in any previous year. The following table shows the production for five years:

	Consumed in Canada. Tons.	Export. Tons.	Total Tons
1900	211,533	8,925	220,458
1901	343,860	81,597	425,457
1902	87,643	33,134	120,777
1903	498,166	162,952	661,118
1904	581,634	162,366	744,000
Production of coke:			
1900	45,145	28,051	73,496
1901	89,678	35,407	125,085
1902	87,643	33,134	120,777
1903	136,650	31,089	167,739
1904	138,976	105,924	244,000

The firms of William T. Wood & Co., Arlington, Mass., and Gifford Bros., Hudson, N.Y., manufacturers of ice tools, have been consolidated and incorporated as the Gifford-Wood Company. The business books of the corporation opened February 1. The main office will be at Hudson, where the foundry work and heavy manufacturing will be done, while the forging and skilled labor of finishing will be done at the Arlington shops. The forge shop at Arlington, which was destroyed by fire recently, will be rebuilt immediately. While the details are not wholly decided, the building will probably by 45 x 130 feet, and will be equipped with the most modern machinery and conveniences. The officers of the new corporation are: President, William E. Wood; vice-president, Malcolm Gifford; treasurer, Arthur Gifford; assistant treasurer, William B. Wood; secretary, A. E. Heard.

Weekly production of pig iron in United States was less than 200,000 tons, when the year (1904) opened, the lowest figure since September, 1897. However, a revival started in August and a steady improvement was noted until the end of the year, the blast furnaces producing twice the amount that they were twelve months earlier. According to the Iron Age, the weekly statistics of active blast furnaces was as follows:

	1904.	1903	1902.
January	195,558	353,800	298,460
February	282,995	343,111	332,045
March	318,223	354,733	323,028
April	337,257	376,576	337,424
May	368,241	381,697	352,061
June	336,197	398,139	344,748
July	272,301	395,042	350,890
August	246,092	362,330	336,465
September	291,573	369,933	335,189
October	319,249	361,492	345,048
November	334,249	282,219	337,559
December	357,116	251,181	343,581

New capital to the amount of $3,500,000 has been invested in the works at the Soo, making a total of $5,500,000. Confidence has been so re-established that creditors with claims amounting to $3,550,000 have converted their claims into investments in the property, with the result that the Speyer mortgage, amounting to $1,500,000, has been paid off. All the various works and operations of the company are in full swing. The output of the mines have been sold for all of this year and part of 1906. The charcoal plants are producing 12,000 bushels of charcoal per day, 1,000 gallons of wood alcohol, and 12,000 pounds of acetate of lime. The pulp mill is turning out 100 tons per day. The output of the blast furnaces is entirely consumed by the rail mills which have sufficient orders from Canadian railways to keep them in operation for six months. Large gangs of men are busily engaged in the woods cutting pine and pulpwood. The number of men employed amounts to in the neighborhood of three thousand eight hundred, with operating expenses for the month of December amounting to $550,000.

Production of raw iron, which in 1901 was 39,940,000 tons, increased to 43,480,000 tons in 1902, and reached 45,180,000 tons in 1903. United States stands at the head with a production of 18,010,000 tons, against 17,280,000 tons in 1902, and 15,800,000 in 1901. Germany wrested the second place from Great Britain in 1903, its production being 10,090,000 tons, against 9,400,000 in 1902, and 7,790,000 in 1901. Great Britain occupies third place with an output of 8,810,000 tons, against 8,520,000 tons in 1902, and 7,850,000 in 1901. The output in France which in 1903 amounted to 2,830,000 tons, has increased by 400,421, as compared with 1902, and by 427,428 tons as compared with the production of 1901. Belgium produced 1,300,000 tons in 1903, an increase of 196,301 tons over 1902, and 533,701 tons over 1901. Spain's production amounted to 380,284 tons. The output has decreased in the following countries: Russia, 2,400,000 tons, or 118,404 tons less than in 1902; and 382,065 less than in 1901; Austria-Hungary, 1,320,000 tons, or 108,814 tons, and 82,165 tons less than in 1902 and 1901, respectively; Sweden, 489,700 tons, a decrease of 34,300 and 23,600 tons from the amounts produced in 1902 and 1901, respectively.

New Machinery Works.

J. M. Ross, Sons & Co., Limited, St. Catharines, have just completed a new plant for the manufacture of engines, wood-working machinery and complete saw mills. The buildings are of brick, the main shop being 60 x 300 ft., and the other which adjoins it in the shape of a T is 60 x 110 ft. The new shops are equipped with all the latest machinery and the best methods known have been adopted. The machinery is run by Westinghouse motors.

The departments of the two buildings are devoted to machine shop, blacksmith shop, boiler shop, wood shop, tin shop, and it is already proposed to increase the works which at present are capable of employing 80 to 100 men. The buildings are covered by fire-proof roofing, heated by hot air, and brick and iron is used throughout in their construction.

First Automobile Factory.

The first works built and equipped solely for the manufacture of automobiles in Canada commenced operations within the past month, as a department of the Packard Electric Works at St. Catharines. At present, while all the different buildings are erected, the machine shop is the only place where the full contingent of men is at work. This building is 150 x 60 ft., with a saw-tooth roof and almost the entire walls on either side being glass, making it very bright. The equipment is one that could not be surpassed, as every tool installed is of the latest and most up-to-date pattern, and built and designed for the most accurate work possible.

Among the machines in the shop might be mentioned a Jones & Lamson turret lathe, Cincinnati Milling Machine Co.'s machinery, Fellows' gear shaper, screw machine built by Bardons & Oliver, Landis Tool Co.'s grinding machinery, automatic bolt cutter and key seater, drills by Cincinnati Machine Tool Co., Lodge & Shipley lathes. In the tool room is a universal tool grinder, twist drill grinder, tool room lathes, shapers, power hack saw, etc. Many of these machines are the first of their kind to be installed in Canada.

The power for this shop is supplied by two 15 h.p. Westinghouse induction motors running at 220 volts.

The general lay out of the plant shows extensive thought in connection with the position of the different buildings, which consist of a machine shop, blacksmiths' shop, boiler shop, storehouse and erecting, testing and paint shops. A full description of this plant will appear in a later issue of this paper.

Large Machine Tools.

John Bertram & Sons Co., Dundas, are turning out some unusually heavy work from their shops at the present time. This includes a lead screw thirty feet long, four inches in diameter for a 25-ft. planer for Goldie & McCulloch Co., Galt; a 60-inch boring and turning mill, direct connected to a variable-speed motor, with speed control from 260 to 1,048 revolutions per minute, and a 32-in. lathe, motor driven, for Canadian Westinghouse; planers for new G.T.R. shops at Brantford, one 14 ft. by 48 in. by 48 in., and three 10 ft. 36 x 36, all motor driven; four 24 in. motor-driven lathes and two vertical boring and turning mills, 42 inches, also electrically driven, as well as a tire-turning lathe of 42-in. swing, to turn 67 pairs a day. They have also in course of construction for the Hamilton Steel and Iron Co., a motor-driven punch for punching fish plates, the weight of which is 75,000 lbs., and a rotary planer, 60 in., motor driven, for the Dominion Bridge Co., of Montreal.

Large Addition to Works.

Goldie & McCulloch Co., Limited, of Galt, are adding to their already large works by the completion of a new boiler plant, situated at some little distance from their present establishment. The new shop is a modern building of brick and steel construction, with three traveling cranes running the entire length, one 60-ton and two 30-ton capacity. Two railway sidings enter the place, and an industrial railway connects the different departments. There is an up-to-date power house in connection with the plant. A full complement of machinery and pneumatic tools has been installed, and work is commencing in full swing.

This company is engaged at turning out some very heavy work, and recently made a large consignment to Winnipeg, the cylinder alone for a heavy duty engine weighing about eleven tons, and a fly wheel, the weight of which is 109,-

940 lbs. With the completion of this consignment it will make eight carloads in all that have gone to the Winnipeg Street Railway Co., to carry the compound engine of heavy duty type similar to those recently installed in the Cataract Power Co.'s plant in Hamilton. Other large engines in the course of construction are: a standard compound Ideal of about 325 h.p., for Joseph Simpson Sons Co., Toronto, and a Corliss compound of about 250 h.p., also going to Toronto; one 400 h.p. Wheelock engine for Gilmour Door Co., Deseronto, and several others scarcely as large.

Superior Engines to be Made in Canada.

The Canada Launch Works, Limited, Carlaw avenue, Toronto, have made arrangements with the Lake Shore Engine Works, Marquette, Mich., makers of the well-known Superior gas engines, to manufacture, under license, the styles of gas and gasoline motors turned out by this firm. The Marquette firm have been manufacturing two and four cycle marine motors and four cycle stationary motors. During the last year they have perfected a new style of two cycle marine engine, and it is this new style of two cycle, together with the four cycle marine and stationary engines that the Canada Launch Works will manufacture. In the two cycle type they will make engines from 1 to 8 horse-power, and in the four cycle, from 8 to 60 horse-power.

Lake Shore Engine Works will supply the Canada Launch Works with working drawings, patterns, jigs and timplates of all the motors. The foreman of the Marquette shops will superintend the arrangement of the machine shop the Canada Launch Works are now erecting, and which they intend equipping with the most modern machine tools.

These engines will be equipped with jump spark and float feed carburettor, with the exception of the one horsepower, which will have an efficient generator valve in place of the float feed carburettor.

New Electric Railway.

A company of Montreal capitalists, headed by John W. Molson, is applying to the Provincial Legislature for the charter rights for the Electric Railway Co. of Lac Achigan. They propose building two electric lines, one from St. Jerome to Lac Achigan, running through Shawbridge, Que., and one from St. Jerome to New Glasgow, running through the town of St. Sophie. It is intended to obtain power from two waterfalls along the route. The Brantford & Hamilton Electric Railway have received their charter by the issue of the Governor-General's proclamation, with which they propose to build an electric line from Brantford to Hamilton. The company is to spend $45,000 in the next two years, and to have the road running within the next five years.

The report of the sub-committee appointed to interview the Montreal Street Railway Co., shows that the company desire to extend their franchise thirty-two years beyond the time of their present contract, which has eighteen years yet to run, making in all fifty years. In addition to what the company pays the city, they agree to pay yearly amounts from $100,000 to $200,000, based on a sliding scale. The company now pays the city four per cent. on earnings up to $1,000,000 ; six per cent. from $1,000,000 to $1,500,000; eight per cent. from $1,500,000 to $2,000,000; ten per cent. from $2,000,000 to $2,500,000 ; twelve per cent. from $2,500,000 to $3,000,000, and fifteen per cent. on all over $3,000,000.

Companies Incorporated.

Richelieu Construction Company, Limited, Toronto, share capital, $200,000; purpose to do a contracting business. The directors are: John W. McDonald,

Pioneer Mining Company of Arizona, Rat Portage, share capital, $50,000 ; purpose to develop mining property. The Ontario representative and attorney is George H. Draper of Rat Portage.

Pioneer Mining Company of Arizona, Rat Portage, share capital, $50,000: purpose to develop mining property. The Ontario representative and attorney is George H. Draper of Rat Portage.

Lake Orion Oil and Gas Company of Arizona, Leamington, share capital $40,000; purpose to manufacture and sell oil. The Ontario representative and attorney is Hiram Frank Slater, of Leamington.

Lake Orion Oil and Gas Company, of Arizona, Leamington, share capital $40,000; purpose to manufacture and sell oil. The Ontario representative and attorney is Hiram Frank Slater, of Leamington.

North Bruce Lumber Co., Toronto, share capital $50,000; purpose to manufacture and deal in lumber. The directors are: F. Rielly, J. B. Bartram, H. M. Murton, W. Pinkerton, and A. D. Chisholm, all of Toronto.

Commercial Twine Co., Montreal, capital stock $10,000; purpose to trade in twine, cordage, paper, tar, paint, etc. The directors are: J. R. Converse, J. Marsden, G. Hiam, O. C. Pangman, and J. Oswald, all of Montreal.

Dailey Rotary Engine Co., Galt, share capital $100,000; purpose to manufacture and deal in rotary engines. The directors are: C. Hetherington, R. W. Roelofson, A. J. Oliver, C. Turnbull, and F. E. Brown, all of Galt.

Standard Construction Co., Ottawa, capital stock $1,000,000; purpose to carry on the business of contractors. The directors are: E. J. Chamberlin, J. W. Smith, C. J. R. Bethune, G. E. Fauquier, and H. Christin, all of Ottawa.

Keenan Woodenware Mfg. Co., Owen Sound, share capital $100,000; purpose to manufacture woodwork and woodenware of all kinds. The directors are: J. E. Keenan, J. C. Keenan, W. P. Keenan, and R. T. Keenan, all of Owen Sound.

Great Northern Lumber Company, Limited, Toronto, share capital $50,000, purpose to deal in timber limits, mines, quarries, etc. The directors are: J. Milne, E. D. Watts, W. R. Duff, J. L. Ross and A. W. Holmestead, all of Toronto.

Brick Mfg. and Supply Co., London, share capital $40,000; purpose to manufacture and deal in all kinds of builders' material and supplies. The directors are: W. Tytler, R. G. Wilson, T. Jones, L. Sing, and J. Whittaker, all of London.

Wilberforce Lumber Co., Durham, share capital $40,000; purpose to manufacture lumber, railroad ties, shingles, veneer, telegraph poles, pulpwood, etc. The directors are: G. Sparling, A. S. Hunter, and D. Jamieson, all of Durham.

Gold Stock Manufacturers, Montreal, capital stock $20,000; intend to manufacture and deal in gold, silver, rolled plate and other jewelry. The directors are: T. J. Fisher, A. J. Hart, H. J. Ross, C. Bolt, and F. A. Raab, all of Montreal.

Canada Folding Box Company, Limited, Brantford, share capital $40,000; purpose to manufacture paper boxes and packages. The directors are: M. H. Robertson, J. H. Crompton, C. F. Ramsay, W. A. Russell and B. C. Bell, all of Brantford.

Manitoba Peat Company, Limited, Winnipeg, share capital, $200,000; to manufacture and sell peat and other classes of fuel. The directors are: R. J. Whitla, John Woodman, D. R. Dingwall, Chas. W. Clark and Robert Taylor, all of Winnipeg.

Richelieu Construction Company, Limited, Toronto, share capital, $200,000; purpose to do a contracting business. The directors are: John W. McDonald, Robert L. Brackin, Ella A. Francis, A. E. A. Blackman, and Frank Denton, all of Toronto.

Bonanza Creek Gold Mining Co., Toronto, share capital $1,750,000; purpose to carry on the business of a mining company in all its branches. The directors are: J. Payne, R. Credicott, A. Foster, W. Gilchrist, and T. Taylor, all of Toronto.

Higston-Smith Arms Co., Winnipeg, capital stock $50,000; purpose to acquire and carry on the business of the Higston-Smith Arms Co. To deal in all kinds of sporting goods. The directors are: K. T. Putnam, C. M. Scott, H.

Archibald, and H. B. Tolton, all of Winnipeg.

Bessemer Iron Mines of Ontario, Limited, S. Ste. Marie, share capital $200,000, purpose to carry on mining in all its branches. The incorporators are: R. Henry, E. C. B. Sutton, C. W. Baldwin, T. Bailey and B. Standish, all of S. Ste. Marie. Mich.

Nicola Valley Coal & Coke Company, St. Catharines, share capital $1,000,000; purpose to mine coal, manufacture coke, etc. The directors are: E. A. Jukes, Toronto, W. S. McNamara, H. E. Larkin, F. N. Hara and W. D. Woodruff, all of St. Catharines.

Canadian Ammunition Co., Montreal, capital stock $500,000; purpose to manufacture and sell cartridges, torpedoes, shells, caps, shot, etc. The directors are: L. A. Boyer, H. D. Anthier, J. E. Lareau, D. Thibaudeau, and L. Boyer, all of Montreal.

Rodney Casket Company, Limited, Rodney, share capital, $35,000; purpose to manufacture caskets and other woodenware. The directors are: William N. Lusty, Albert J. Tishner, Benjamin J. Harris, James Ralph, and Harry L. Skane, all of Rodney.

Polson Iron Works, Limited, Toronto, share capital $1,060,000; Dominion charter; to do general iron construction work. The directors are: Alex. H. Jeffrey, William B. Tindall, John J. Mains, Mrs. F. B. Polson, and Mrs. John B. Miller, all of Toronto.

G. R. Gregg & Co., Toronto, capital stock $250,000; purpose to carry on the business of retail and wholesale merchants and manufacturers. The directors are: G. R. Gregg W. E. Hazley, W. G. O'Loughlin, W. Lough, and T. Gregg, all of Winnipeg.

The Plating and Specialty Company, Limited, Brantford, share capital, $40,000; purpose to do plating and handle hardware specialties. The directors are: George W. Markle, Charles J. Farr, Fanny Munro, Ellen B. Witty and Alice Witty, all of Brantford.

British-Canadian Supply Co., Montreal, capital stock $50,000; purpose to carry on a general supply and contracting business in all kinds of materials. The directors are: W. Jack, J. W. Harris, R. C. Smith, W. B. Powell, and R. C. Grant, all of Montreal.

Dominion Camp Equipment Company, Limited, Montreal, share capital $20,000, purpose to manufacture and deal in camp ranges, etc. The directors are: D. W. Lockerby, A. H. Scott, J. H. McComb, A. M. Wolvenden and C. A. Lockerby, all of Montreal.

Maritime Express Co., Ottawa, capital stock $15,000; purpose to carry on the business of a general express company. The directors are: F. H. Crysler, C. J. R. Bethune, N. G. Larmonth, and C. G. Chrysler, all of Ottawa, and P. Gifkins, of Kentville.

Buffalo & Leamington Oil & Gas Co., Windsor, share capital $100,000; purpose to explore and operate for petroleum oil, gas and salt. The directors are: E. Wigle, of Leamington, C. L. Meyer, township of Pelee, county of Essex, and J. J. Gemmell, of Perth.

Canadian Corundum Wheel Co., Hamilton, share capital $40,000; purpose to manufacture and sell corundum and emory wheels and emory wheel grinding machines. The directors are: L. Sherk, H. E. Sherk, G. F. Webb, W. Bell, and A. S. Devine, all of Hamilton.

Commercial Rubber Company, Limited, Montreal, share capital $20,000; purpose to develop water and electric power and manufacture rubber goods. The directors are: R. D. McGibbon, D. Armour, S. J. Le Huray, K. J. Beardwood, and L. L. Legault, all of Montreal.

Stratford Mill Building Co., Stratford, share capital $200,000; purpose to manufacture and sell mill machinery, boilers, engines, threshers and separators and other machinery. The directors are: W. Preston, J. B. Greig, and E. M. Preston, all of Stratford.

Canadian Appraisal Company, Limited, Montreal, share capital $50,000; purpose to make surveys, construct industrial plants, adjust properties, audit books, etc. The directors are: F. Paul, W. M. Doull, P. C. Ryan, L. Guest, H. Seymour and E. Dowson, all of Montreal.

McLennan Timber Lands and Lumber Company, Limited, Quebec, share capital, $50,000; to manufacture and sell lumber. The directors are: John McLennan, Syracuse, N.Y.; A. J. Price, Notre Dame de Quebec; C. E. Taschereau, L. A. Taschereau, and F. Roy, all of Quebec.

The Premier Electric Light and Power Co., Wallaceburg, share capital $40,000; purpose to operate works for the production and sale of electricity for the purpose of light, heat and power. The directors are: W. D. McRae, D. C. MacDonald and H. A. Stonehouse, all of Wallaceburg.

Diamond Dry Powder Fire Extinguisher Company, Limited, Toronto, share capital, $40,000; purpose to manufacture powder for extinguishing fire. The directors are: George Robert Simpson, William D. Earngey, William J. Curry, Norman W. Tovell, and Joseph Whaley, all of Toronto.

Dominion Cement Block Machine Company, Limited, Ottawa, share capital $100,000; purpose to deal in cement block machinery, construct buildings, etc. The directors are: C. A. Irvin, C. H. Hutchings, and H. P. Fleming, of Ottawa, and C. E. B. Adams and J. H. Hall of Toronto.

Canada Tin Plate and Sheet Steel Co. Morrisburg, share capital $1,500,000; purpose to manufacture every description of iron, steel, tin and other metal work. The directors are: N. D. Lewis, of Wales, England; J. A. Meldrum, W. D. Cavendish, A. E. Panter, and B. D. Cole, all of Toronto.

A. Weller & Co., Toronto, share capital $40,000; purpose to acquire and assume and continue as a going concern, the business of builders and contractors heretofore carried on by the late A. Weller and J. Stares. The directors are: J. Stares, W. Weller, and J. Weller, all of Toronto.

Eureka Planter Co., Woodstock, share capital $50,000, purpose to take over the assets of the Eureka Planter Company and manufacture and trade in agricultural and other implements, tools, etc. The directors are: J. A. Straith, S. B. Best, C. N. Choate, A. McNee, and P. J. Freeman, all of Windsor.

McFarlane, Thompson & Anderson Manufacturing Company, Limited, Fredericton, N.B., share capital $75,000; purpose to carry on a general manufacturing business in iron and wood. The directors are: Hon. F. P. Thompson, W. Kitchen, W. T. Whitehead, C. A. Miles, and A. J. Thompson, all of Fredericton.

Hill Crest Coal & Coke Company, Limited, Montreal, share capital $500,000; purpose to mine coal, manufacture coke, etc. The directors are: R. H. Pope, Cookshire, Que.; G. W. Fowler, Sussex, N.B.; M. P. Davis, Ottawa; W. Farewell, Sherbrooke, Que.; R. A. Pringle, Cornwall, Ont., and C. P. Hill, Frank, Alberta.

Anglo-Canadian Leather Co., Montreal, capital stock $2,000,000; purpose to carry on the business of importing, exporting, tanning, manufacturing and dealing in hides and leather of every description. The directors are: B. Shaw, Boston, Mass.; C. T. Shaw, T. D. Stewart, B. A. Shaw, and F. C. Bush, all of Montreal.

Canadian Builders, Limited, Toronto, capital stock $1,000,000; purpose to carry on the business of contractors and constructors, also to deal in lands, mortgages, etc. The directors are: G. P. Magann, J. MacKay, and W. H. Blake, all of Toronto; J. C. Stewart, of New York, and C. F. Franson, of Pittsburg.

Hamilton Incubator Co., Hamilton, share capital $10,000; purpose to manufacture, buy and sell farm implements and household appliances of all kinds, incubators, brooders, stock-raising apparatus and machinery. The directors are: J. Fletcher, of Mount Albion, and D. H. Fletcher and G. M. Jones, both of Hamilton.

The Toronto Pressed Steel Co., Toronto Junction, share capital $100,000; purpose to manufacture and sell railway supplies and contractors' supplies, including wheel and drag scrapers and other implements. The directors are: J. R. L. Starr, J. H. Spence, T. E. Wilson, A. A. Rogers, and S. Whittaker, all of Toronto.

The French River and Nipissing Navigation Co., Sturgeon Falls, share capital $25,000; purpose to construct and navigate boats, scows and steam vessels, for the conveying of all manner of merchandise. The directors are: J. A. Clark and J. W. Hendrie, both of Sturgeon Falls, and Wm. Hendrie, Jr., of Hamilton.

Acme Mfg. Co., Toronto, share capital $40,000; purpose to manufacture, deal, and sell all kinds of weighing scales, scales machinery, engines, boilers, motors, motor vehicles, electrical appliances, electrical machinery, implements, plumbers' supplies, foundry supplies, etc. The directors are: J. T. Eastwood, N. Murphy, E. E. Wallace, F. Hodgson, and A. J. Walker, all of Toronto.

MACHINERY BUYERS' DIRECTORY.

Readers of CANADIAN MACHINERY are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principal firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

Abrasive Materials.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Arc Lamps.
Canadian General Electric Co., Toronto.
The United Electric Co., Toronto.

Air Brakes.
Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Back Pressure Valves.
Sheldon & Sheldon, Galt, Ont.

Barrels, Tumbling.
The Globe Machine and Stamping Co., Cleveland, Ohio.
A. R. Williams Co., Toronto

Bars, Boring.
Niles-Bement-Pond Co., New York.

Belting, Leather.
The Fairbanks Co., Montreal.
Sadler & Haworth, Montreal.
A. R. Williams Co., Toronto.

Belting Supplies.
Sadler & Haworth, Montreal.
A. R. Williams Co., Toronto.

Bending Machinery.
Niles-Bement-Pond Co., New York.

Blowers.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.
A. R. Williams Co., Toronto.

Boilers.
Levy, Weston & McLean, Machine Co., Toronto.
A. R. Williams Co., Toronto.

Bolt Cutters.
National Machinery Co., Tiffin, Ohio.

Bolt and Nut Machinery.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Books, Mechanical.
The MacLean Pub. Co., Ltd., Toronto

Boring and Drilling Machines.
Niles-Bement-Pond Co., New York.

Boring and Turning Mills.
American Tool Works Co., Cincinnati.
A. R. Williams Co., Toronto.

Bulldozers.
National Machinery Co., Tiffin, Ohio.

Cabinets, Tool.
Armstrong Bros. Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Centring Machines.
Pratt & Whitney Co., Hartford, Conn.

Centres, Planer.
Pratt & Whitney Co., Hartford, Conn.

Chucks, Drill and Lathe.
Ker & Goodwin, Brantford.
Niles-Bement-Pond Co., New York.
A. R. Williams Co., Toronto.

Circuit Breakers.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Clucking Machines.
American Tool Works Co., Cincinnati.
A. R. Williams Co., Toronto.

Compressors, Air.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
A. R. Williams Co., Toronto.

Controllers and Starters, Electric Motor.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock Co., Montreal.

Cotton Belting.
Sadler & Haworth, Montreal.

Cupola Blowers.
Sheldon & Sheldon, Galt, Ont.

Cutters, Milling.
Becker, Brainard Milling Machine Co. Hyde Park, Mass.

Cutting-off Machines.
Hurlbut-Rogers Machine Co., South Sudbury, Mass.
Pratt & Whitney Co., Hartford, Conn.
A. R. Williams Co., Toronto.

Cutting-off Tools.
Armstrong Bros. Tool Co., Chicago.
Pratt & Whitney, Hartford, Conn.
A. R. Williams Co., Toronto.

Dies, Opening.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.
The Globe Machine and Stamping Co., Cleveland, Ohio.
A. R. Williams Co., Toronto.

Dies, Threading.
Pratt & Whitney Co., Hartford, Conn.

Drills, Bench.
B. F. Barnes Co., Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drills, Centre.
Pratt & Whitney Co., Hartford, Conn

Drills, Horizontal.
B. F. Barnes Co., Rockford, Ill.

Drills, Ratchet.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler.
American Tool Works Co., Cincinnati.
Bickford Drill and Tool Co., Cincinnati.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Drilling Machines, Multiple Spindle.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Bickford Drill & Tool Co., Cincinnati.
Niles-Bement-Pond Co., New York.
A. R. Williams Co.. Toronto.

Drilling Machines, Pneumatic
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Niles-Bement-Pond Co., New York.

Drilling Machines, Radial.
American Tool Works Co., Cincinnati.
Bickford Tool & Drill Co., Cincinnati.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Drilling Machines, Upright.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
A. R. Williams Co., Toronto.

Drop Forging.
The Globe Machine and Stamping Co., Cleveland, Ohio.
A. R. Williams Co., Toronto.

Drop Forging Dies.
The Globe Machine and Stamping Co., Cleveland, Ohio.
A. R. Williams Co., Toronto.

Drying Apparatus of all Kinds.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dust Separators.
Sheldon & Sheldon, Galt, Ont.

Dynamos.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Packard Electric Co., St. Catharines.
United Electric Co., Toronto.
A. R. Williams Co., Toronto.

Electrical Supplies.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The United Electric Co., Toronto.
Packard Electric Co., St. Catharines.

Electrically Driven Tools and Machinery.
American Tool Works Co., Cincinnati.
A. R. Williams Co., Toronto.

Electrical Repairs.
Volta Electric Repair Works, Toronto.

Emery Wheel Dressers.
The Globe Machine and Stamping Co., Cleveland, Ohio.
A. R. Williams Co., Toronto.

Engines.
Levy, Weston & McLean Machinery Co., Toronto.
A. R. Williams Co., Toronto.

Engineers' Supplies.
Levy, Weston & McLean Machinery Co., Toronto.
A. R. Williams Co., Toronto.

Engines, Gas and Gasoline.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Engines, Steam.
The Goldie & McCulloch Co., Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.
A. R. Williams Co., Toronto.

Exhaust Fans.
Sheldon & Sheldon, Galt, Ont.

Exhaust Heads.
Sheldon & Sheldon, Galt, Ont.

Expanded Metal.
Expanded Metal and Fireproofing Co., Toronto

Fans, Electric.
Canadian General Electric Co., Toronto.
B. F. Sturtevant Co., Hyde Park, Mass.

Feed Mills.
S. Vessot & Co., Toronto.
A. R. Williams Co., Toronto.

Files.
G. & H. Barnett Co., Philadelphia.
A. R. Williams Co., Toronto.

Forges.
Sheldon & Sheldon, Galt.
A. R. Williams Co., Toronto.

Forging Machinery.
National Machinery Co., Tiffin, Ohio.

Gang Drills.
B. F. Barnes Co., Rockford, Ill.

Gauges, Standard.
Pratt & Whitney Co., Hartford, Conn.

Gear Cutting Machinery.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
A. R. Williams Co., Toronto.

Generators.
The United Electric Co., Toronto.
Canadian General Electric Co., Toronto.
A. R. Williams Co., Toronto.

Grinders, Centre.
Niles-Bement-Pond Co., New York.

Grinders, Cutter.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Cincinnati Milling Mach. Co., Cincinnati.
Pratt & Whitney Co., Hartford, Conn.
A. R. Williams Co., Toronto.

Grinders, Tool.
Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
A. R. Williams Co., Toronto.

Grinding and Polishing Machines.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Hammers, Pneumatic.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Niles-Bement-Pond Co., New York.

Heaters and Fans.
Sheldon & Sheldon, Galt, Ont.

Hoisting and Conveying Machinery.
Niles-Bement-Pond Co., New York.

Hoists, Pneumatic.
Canadian Rand Drill Co., Montreal.

Hot Blast Heating Apparatus.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Injectors.
Penberthy Injector Co., Windsor Ont.

Iron Tools.
Levy, Weston & McLean Machinery Co. Troonto.
A. R. Williams Co., Toronto.

Lace Leather.
Sadler & Haworth, Montreal.

Lathe Dogs.
Armstrong Bros., Chicago.
Pratt & Whitney Co., Hartford, Conn.

Lathes.
American Tool Work Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
R. McDougall & Co., Galt, Ont
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Sebastian Lathe Co., Cincinnati, O.
A. R. Williams Co., Toronto.

Lathes, Automatic, Screw-Threading.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.
Pratt & Whitney Co., Hartford, Conn.

Leather Belt Dressing.
Sadler & Haworth, Montreal.

Leather Belting.
Sadler & Haworth, Montreal.

Leather Belting, Waterproofed.
Sadler & Haworth, Montreal.

Lumber Dry Kilns.
Sheldon & Sheldon, Galt.
A R. Williams Co., Toronto.

Machine Tools.
B. F. Barnes Co., Rockford, Ill.

Machinery Dealers.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.
C. C. Wormer Mach. Co., Windsor.

Machinists' Small Tools.
Armstrong Bros., Chicago.
Pratt & Whitney Co., Hartford, Conn.

Mechanical Draft.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.
A R. Williams Co., Toronto.

Metallic Lacing.
Sadler & Haworth, Montreal.

Milling Attachments.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Niles-Bement-Pond Co., New York,
Pratt & Whitney Hartford, Conn.

Milling Machines, Horizontal.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Niles-Bement-Pond Co., New York.
Pratt & Whitney, Hartford, Conn.

Milling Machines, Plain.
American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Cincinnati Milling MachineCo.,Cincinnati
The Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
A. R. Williams Co., Toronto.

Milling Machines, Universal.
American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Cincinnati Milling MachineCo.,Cincinnati
The Fairbanks Co., Montreal.
Levy, Weston & McLean Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.

Milling Machines, Vertical.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Niles-Bement-Pond Co., New York.

Mining Machinery.
Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.

Motors.
Canadian General Electric Co., Toronto.
The United Electric Co., Toronto.
A. R. Williams, Co., Toronto.

Motors, Electric.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
A. R. Williams Co., Toronto.

Nut Tappers.
National Machinery Co., Tiffin, Ohio.

Oatmeal Mill Machinery.
The Goldie & McCulloch Co., Galt.

Pipe Cutting and Threading Machines.
Niles-Bement-Pond Co., New York.
Oster Mfg. Co., Cleveland, O.

Planers.
American Tool Works, Cincinnati.
Cincinnati Planer Co., Cincinnati.
The Fairbanks Co., Montreal.
Levy, Weston & McLean Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
A. R. Williams Co., Toronto.

Planing Mill Fans.
Sheldon & Sheldon, Galt Ont.

Pulleys.
The Dodge Mfg. Co., Toronto.
The Fairbanks Co., Montreal.
The Goldie & McCulloch Co., Galt.
A. R. Williams Co., Toronto.

Pumps.
Canada Foundry Co., Toronto.
The Goldie & McCulloch Co., Galt.
A. R. Williams Co., Toronto.

Punches and Dies.
The Globe Machine and Stamping Co., Cleveland, Ohio.
A. R. Williams Co., Toronta.

Punches, Power.
Niles-Bement-Pond Co., New York.

Presses, Hydraulic.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niles-Bement-Pond Co., New York.

Reamers.
Pratt & Whitney Co., Hartford, Conn.

Riveters, Hydraulic.
Niles-Bement-Pond Co., New York.

Riveters, Pneumatic.
Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.
Niles-Bement-Pond Co., New York.

Rubber Belting.
Sadler & Haworth, Montreal.

Sawing Machines, Metal.
Niles-Bement-Pond Co., New York.

Saw Mill Machinery.
Levy, Weston & McLean Machine Co., Toronto.
A. R. Williams Co., Toronto.

Second-hand Machinery.
Levy, Weston & McLean Machine Co., Toronto.
H. W. Petrie, Toronto.
A. R. Williams Co., Toronto.
C. C. Wormer Mach. Co., Windsor.

Screw Machines, Automatic.
Pratt & Whitney Co., Hartford, Conn.

Screw Machines, Hand.
Pratt & Whitney &o., Hartford, Conn.

Screw Plates.
Oster Mfg. Co., Cincinnati, O.

Shapers.
American Tool Works Co., Cincinnati.
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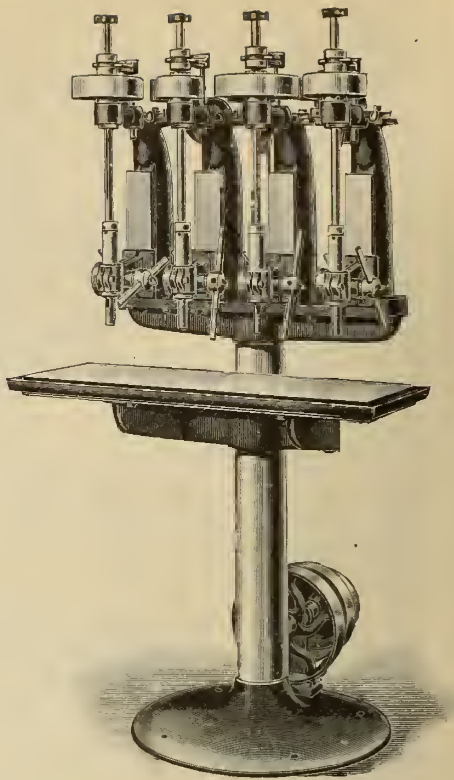

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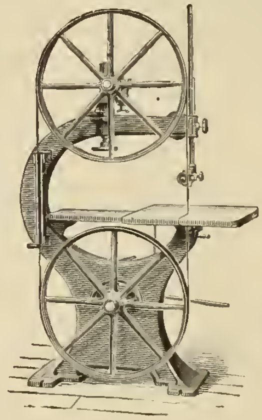

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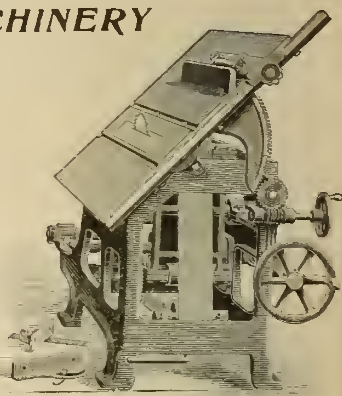

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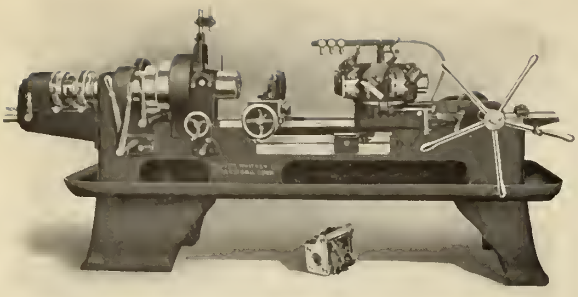

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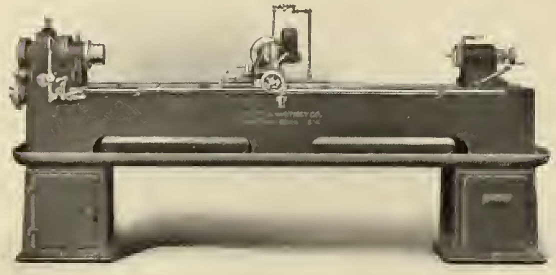

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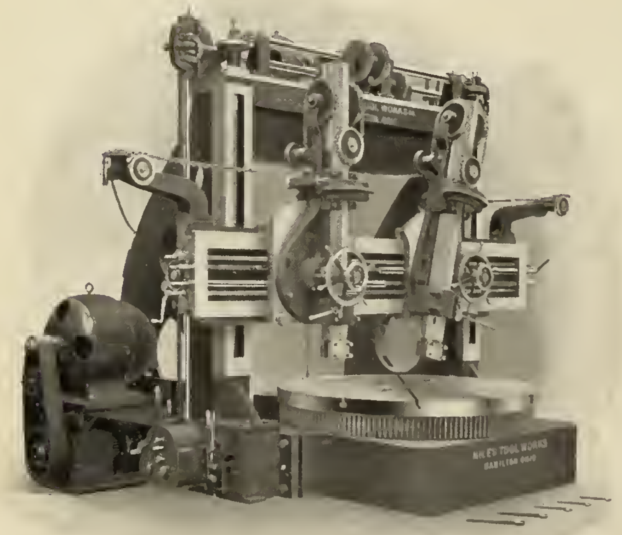
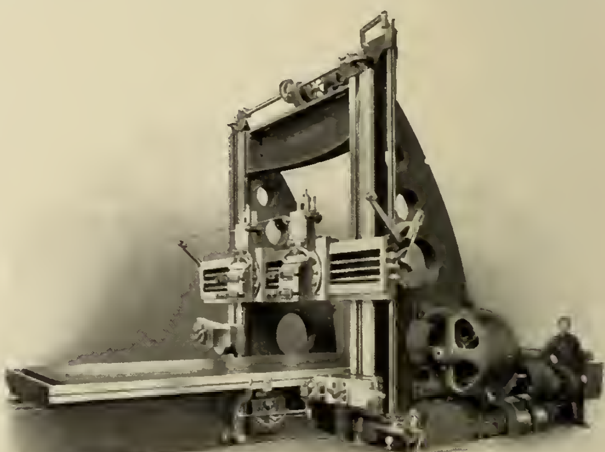


Nile's 10 foot Boring and Turning Mill.



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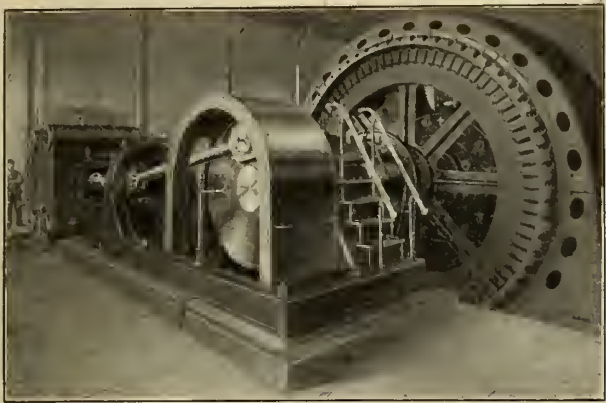

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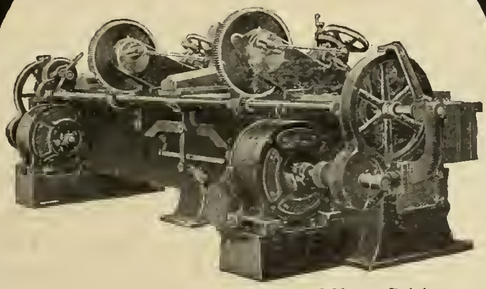

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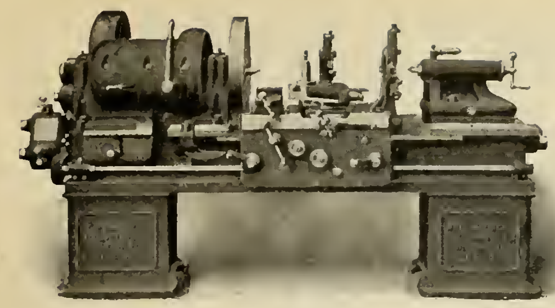

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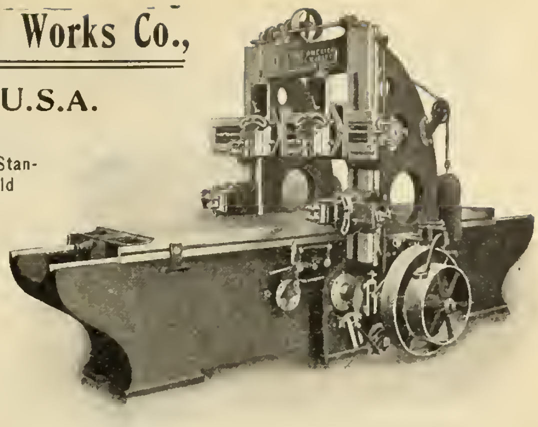

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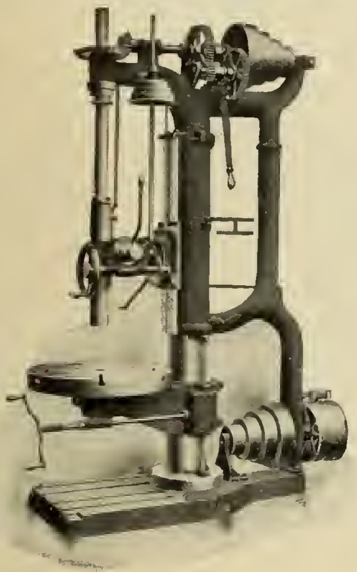

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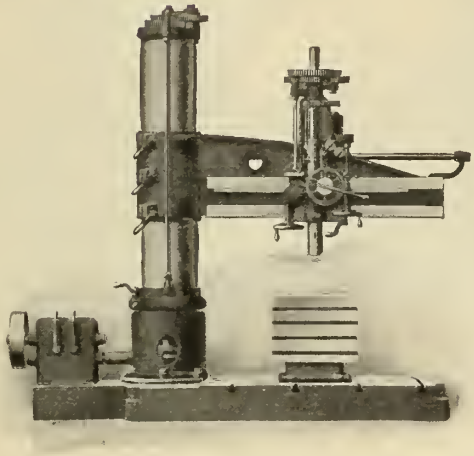

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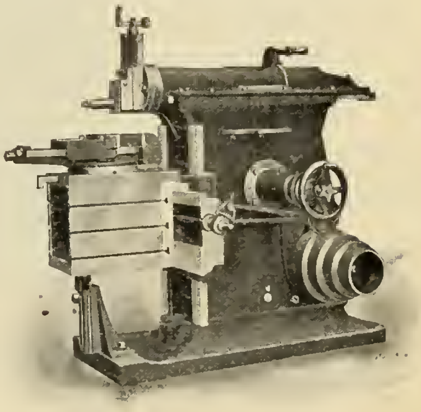

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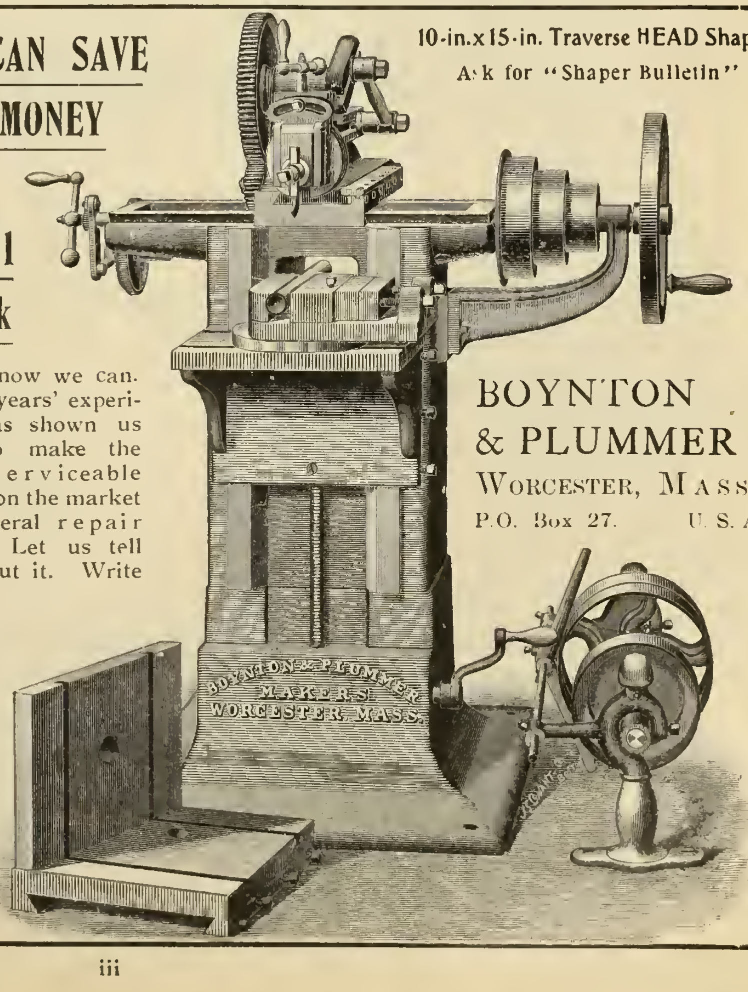

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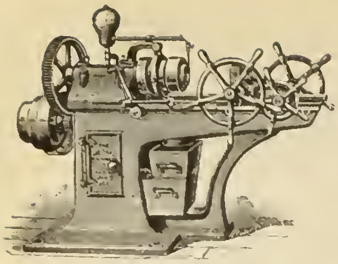

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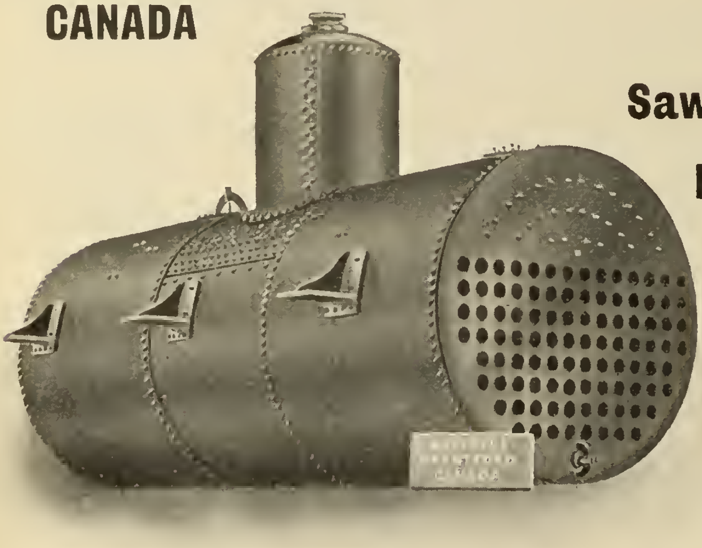

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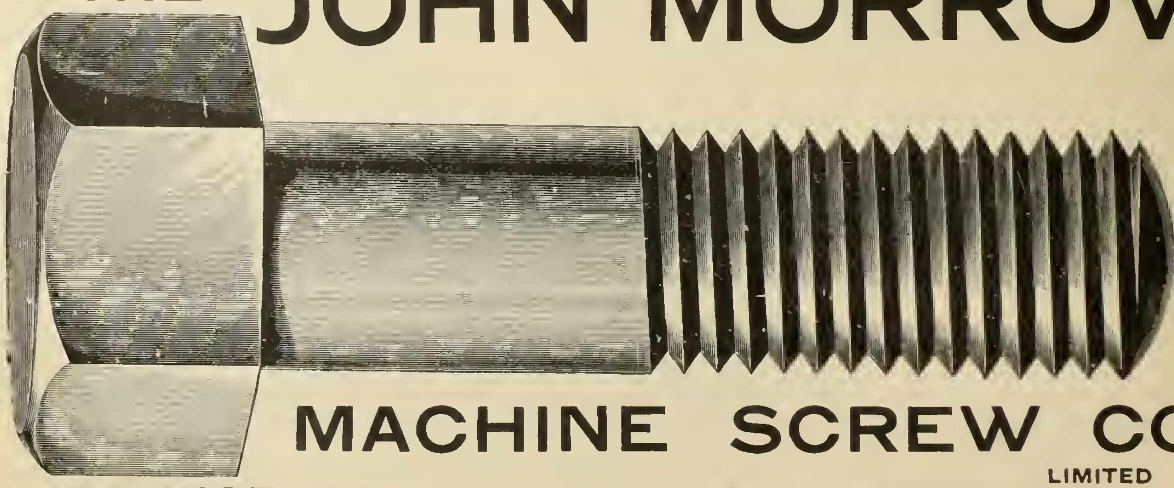

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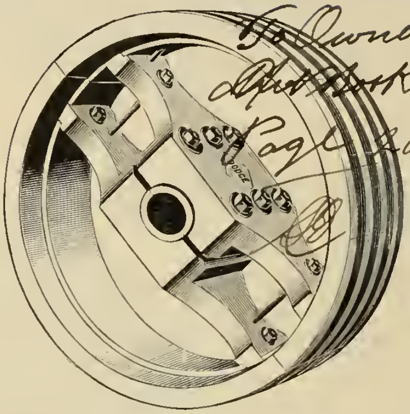

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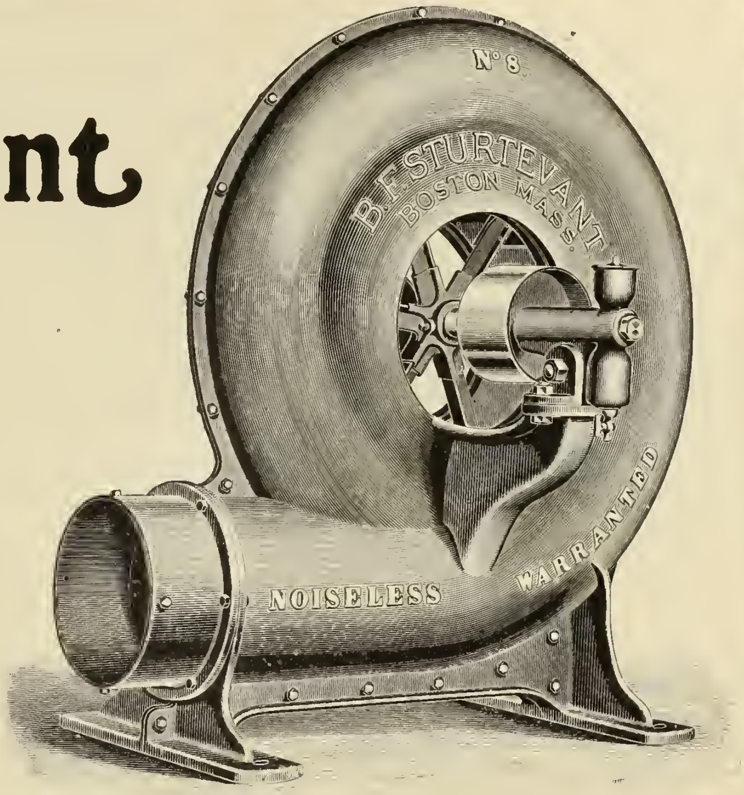

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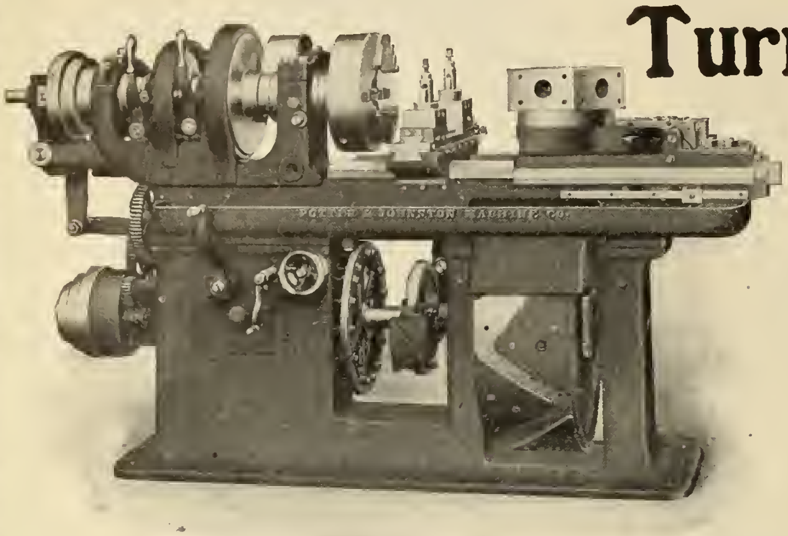

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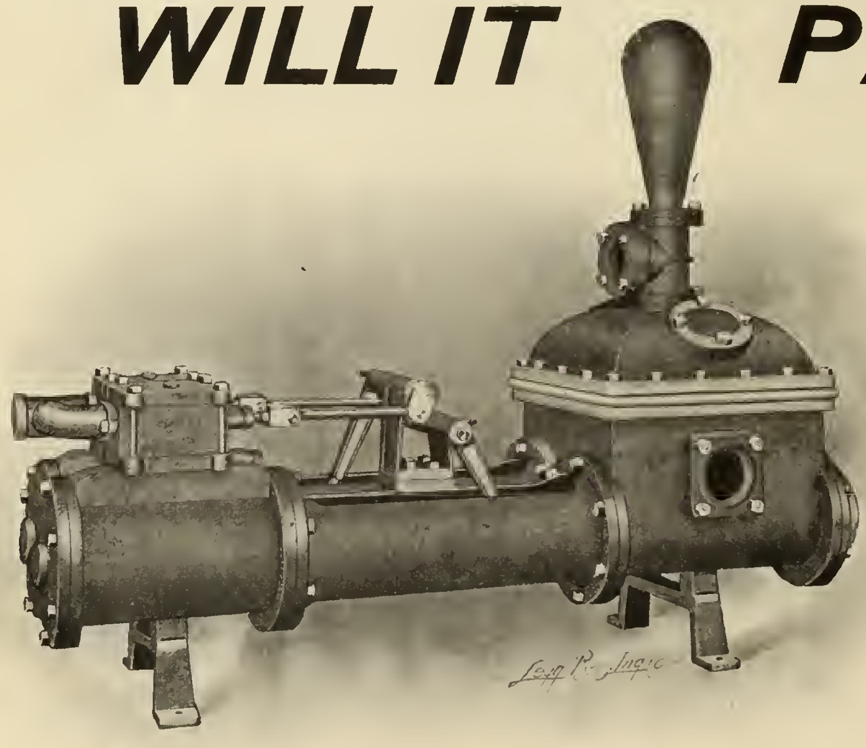

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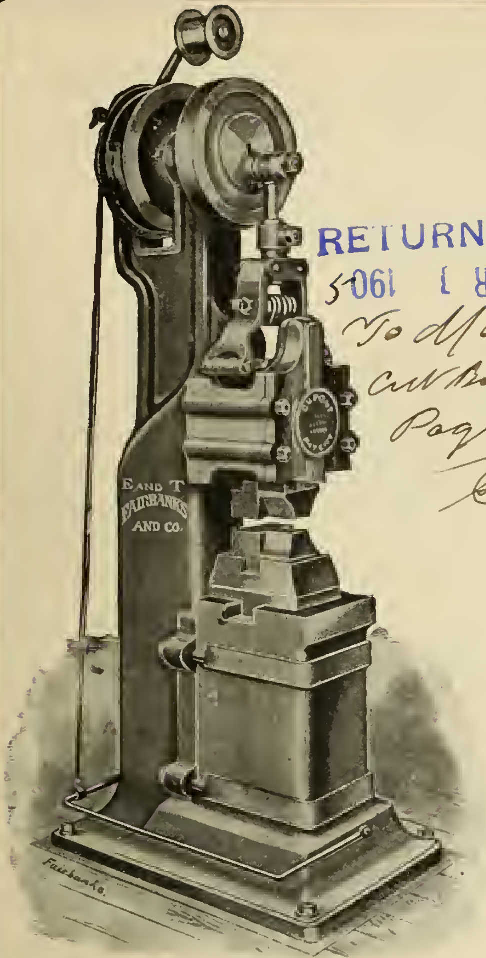

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Here's the difference between Hand Forging vs. Forging with Fairbanks' Hammer:

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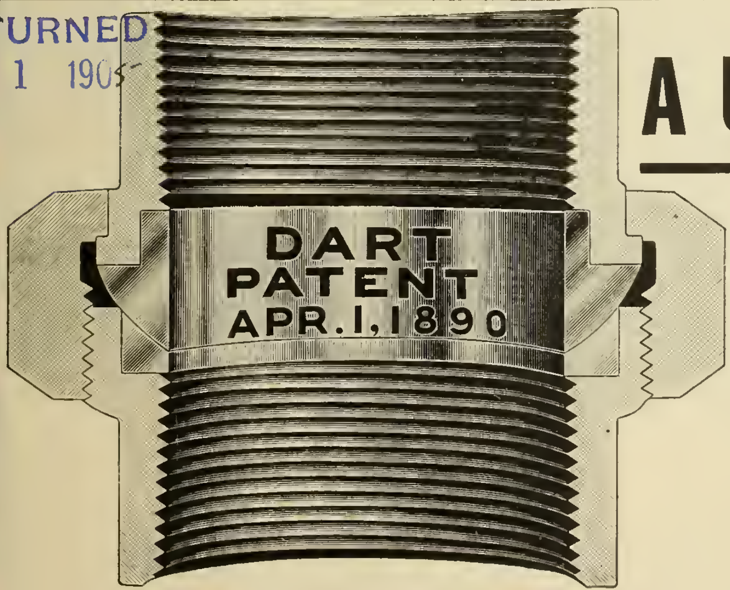

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At the present time there is no branch of engineering receiving more attention

To Cann
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Page 19

Stationary Pneumatic Yoke Rivetter.

than compressed air (and its applications) merited by its steady development and great possibilities. The value of compressed air as a motive power is directly due to its transmission qualities and its comfort to the operator. It has given a flexibility to the manufacturing plant hitherto impossible, for, the mains once laid and convenient openings provided, any tool may be used at any part of the shop. The value of this is at once apparent, because whatever was formerly done by hand or moved to the stationary tool, is accomplished on the spot in far less time and in a better manner by the pneumatic tool. Where the use of steam was prohibitive on account of the condensation difficulties, the discomfort to the operator, and the impossibility of designing tools for efficient operation, compressed air is being used with most gratifying results. Its only rival from the standpoints of transmission, adaptability, cost of installation, and maintenance, is electricity ibut in many appliances the air tools have undisputed preference.

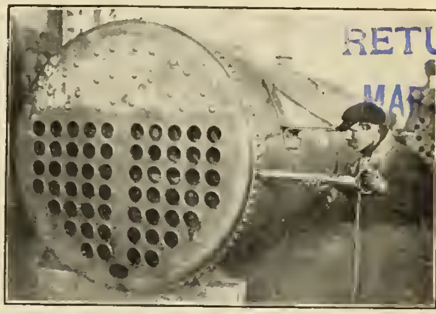
Compressed air in mining and quarrying operations has long been appreciated, but only of later years has the development of numerous pneumatic appliances brought it into the greater industrial world. This development has been slow, but in view of the wide interest now being manifested, there is every reason to anticipate that the already high efficiency of the tools will be advanced and many more appliances designed with a view towards widening the sphere of usefulness of this valuable power.

No modern foundry, structural, boiler or machine shop is complete without its complement of air tools, and in these branches of industry compressed air has made its greatest strides. The illustrations in this article were taken in the above departments of the Davenport Works of the Canada Foundry Company, Limited, Toronto, and the percentages of saving shown are the averages of a number of operations.

Referring especially to the applications illustrated, the pneumatic hammer stands first as the most serviceable tool. For chipping castings and boiler plates it shows a saving over hand chipping of 70 per cent. and in its most important field, the boiler shop, the results are almost incredible. The following table will give a fair idea of what this tool has accomplished:

Class of Work.	Per cent. of cost saved
Rivetting	68
Beading	76
Chipping flue sheet	85
Cutting off stay bolt heads	60
Cutting out broken fire box stays	72

Next in importance in the boiler shop is the pneumatic drill, which for general work shows a saving of 75 per cent. to 80 per cent. In addition to these tools this department of the Canada Foundry Company is equipped with



Pneumatic Hammer Rivetting.

a hydro-pneumatic accumulator, supplying power to a large flanging press, punches, including manhole and handhole punches, shears and a bull riveter. The pneumatic drill and reamer, as shown in the illustration, is invaluable for such work as cannot be conveniently placed under the drill press. The breast drill shows over 90 per cent. saving in cost and time over the old ratchet hand drill, and the following results are fair averages for the post drill:

Class of Work.	Per cent. of cost saved.
General machine shop work	78
General boiler shop work	76
Drilling for stays	52
Tapping for stays	66
Reaming crown sheet	72
Facing steam pipes	77

The illustration from the structural shop shows one form of stationary pneumatic yoke riveter. Several portable riveters are also used and each type has its special advantages. For heavy

Pneumatic Chipping Hammer.

work the portable type is unquestionably quicker. The saving with these tools over hand work is about 66 per cent.

There is a still more efficient hydro-pneumatic riveter not as yet in general use, in which the vertical adjustment is

controlled by a three-way valve, and the hammer stroke by a foot valve.

Although compressed air is best known in connection with the mining, quarrying and metal working industries, there are hundreds of other applications showing large savings and no less important in their particular duties. Amongst these are the following pneumatic appliances:

Hoists, accumulators, locomotives, brakes, jacks, cranes, ejectors, elevators, sand blast apparatus, painting apparatus, dump cars, sanders for locomotives, bell ringing apparatus, flue cleaners, glass and metal blowers, stone cutters, copying and straightening presses, street sweepers, block signals, canal locks operation, etc., etc. In addition to these, the application of compressed air to many stationary engines, hoisting engines, pumps, etc., has obviated the difficulty of long steam transmission, while

Pneumatic Hammer Beading Boiler Flues.

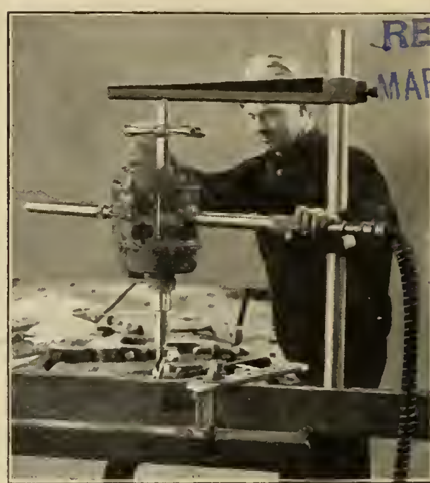
its direct application for the purpose of cleaning electrical machinery, car cushions, carpets, etc., the refining of asphalt, the agitation of syrups in the sugar refineries and slag in the cement works, the aerating of liquids, and for the raising of water from deep wells, is showing highly satisfactory results.

The following figures showing percentages of saving with miscellaneous pneumatic appliances, may be interesting:

Tool.	Class of Work.	Per cent of cost saved.
Paint sprayer	Painting box cars	69
Paint sprayer	Painting car trucks	88
Paint burner	On passenger cars	68
Sand blast	Cleaning tanks	92
Air jet	Cleaning cushions	51
Driving box press	Pressing brushes	69
Stay bolt nippers	Cutting off stays	85

The application of the air brake to street cars is at present receiving particular attention. The numerous accidents, due in part to the sluggishness of the hand brake, are bringing home to the street railway companies the necessity of a more efficient device for this important duty. That the air brake, so indispensable to the larger railways, will fill this need, has been proved beyond experiment. Many long distance trolley lines and some street lines are already equipped, and just as in steam railway service, where the suburban lines requiring numerous quick stoppages were most benefited by the advent of the air brake, in street service, where the stops are much more frequent, the gain is more apparent. There are two methods of generating compressed air for this service, both of which have been successfully carried out. One is by having separate generating units under each car, and the other by having generating units distributed at long intervals throughout the system from which storage tanks under the cars are filled. The Canada Foundry Company recently equipped a number of Montreal street cars in the former manner, and the result has been eminently satisfactory.

Referring briefly to the modern production of compressed air, the Canada Foundry Company has lately developed a new compressor, a cut of which is printed here. This machine has several new features and represents a marked advancement in this class of machinery. It is entirely self-contained on a strongly ribbed box frame. A central crank and connecting rod are used and the crank end is completely enclosed. Provision is made for easy access to adjustable parts. The crosshead moves in a bored guide and has adjustable shoes at top and bottom. A large oil reservoir is situated in the main frame at the crank end and a disc mounted on this crank shaft dipping in this reservoir, conveys oil up to a scraper resting on the disc rim, which guides the oil to a



Pneumatic Drill and Reamer.

smaller reservoir. At slowest speed, sufficient oil is raised to this "head" to supply main bearings, crank pin, eccentrics, crosshead pin and guides, with continuous streams of oil. After passing over the wearing surfaces the oil flows back by gravity to the main reservoir and is used over and over again. The enclosed end is specially constructed with a view to preventing any splashing or leakage of oil.

The steam cylinder is covered with heat retaining material and the main valve is fitted with Meyer adjustable cut-off plates.

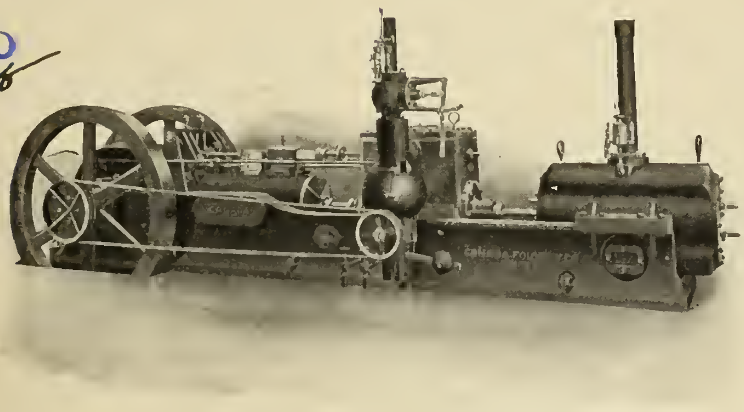
A section view of the air cylinder is reproduced here and an air indicator card from one of the machines recently built. The section view of the cylinder shows that special attention has been given to

Pneumatic Metal Blower.

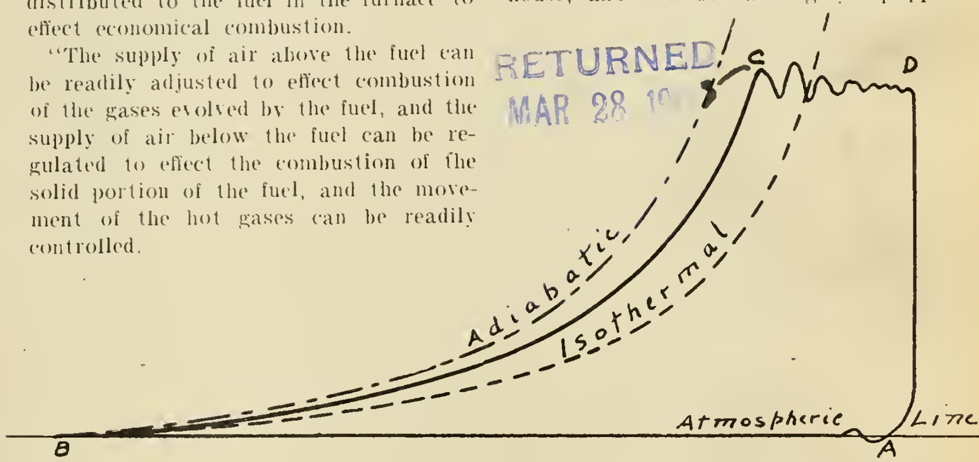
clearance and water jacketing. The outlet valves are the ordinary poppet type except that when open the bronze guide supports the valve down to the bottom.

The inlet valves are weldless, annular rings of steel mounted on steel balls. There is one valve in each head and they are prevented from being drawn into the cylinder by solid lugs on valves and heads. Light springs are used to close them at the end of the stroke. The high volumetric efficiency obtained with these valves is demonstrated by the indicator card shown. The indicator card also shows effective cooling and ample outlet area. The same design has been carried out in the duplex compound types, and this company is prepared to supply self-contained, self-oiling compressors of this kind for all duties, with either plain slide or Corliss steam valves.

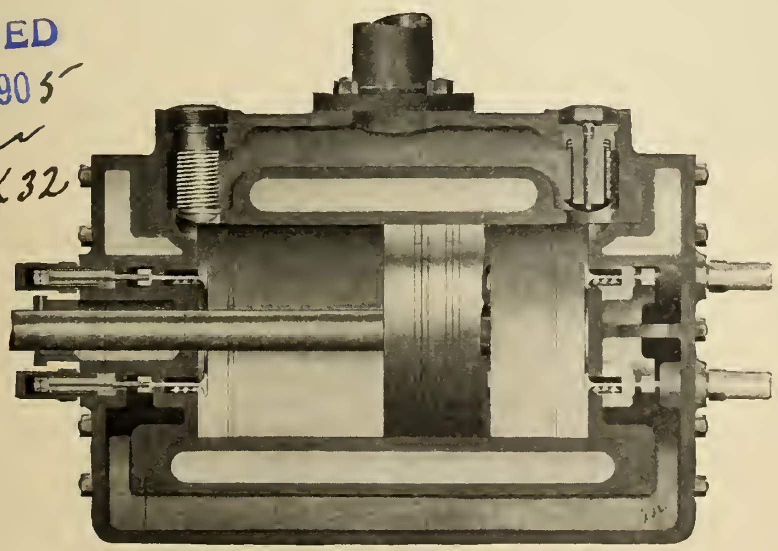
The aim of the manufacturers has been to produce a compressor second to none, and the result is a highly efficient, simple, self-oiling, self-contained machine, not requiring an expensive foundation nor high erection charges.



Straight Line Air Compressor, No. 762, Type 1. Recently developed by the Canada Foundry Company.



Indicator Card from 12 x 12 x 18, Type 1 Compressor. Built by the Canada Foundry Company.



Air Cylinder Section.

MECHANICAL DRAFT.

"Artificial draft," so states Mr. W. S. Hutton, "can be readily adjusted to effect the combustion of different kinds of fuel at different rates of combustion. It permits efficient combustion of fuel of inferior quality, and enables a steady supply of steam to be maintained, independent of climate and weather. It enables the supply of air to be properly distributed to the fuel in the furnace to effect economical combustion.

"The supply of air above the fuel can be readily adjusted to effect combustion of the gases evolved by the fuel, and the supply of air below the fuel can be regulated to effect the combustion of the solid portion of the fuel, and the movement of the hot gases can be readily controlled.

"There is no valuable feature of the chimney that is not possessed by the fan to at least the same, and in many cases to a more marked degree. The very features which are most conducive to economy are those which are incidental to the use of the fan for draft production. While the recent extensive introduction of induced draft in stationary practice has done much to emphasize the advantages of this system, the general superiority of mechanical draft, properly applied, has long been recognized by those who have given careful consideration to the matter."—Extract from Treatise on Mechanical Draft, published by The B. F. Sturtevant Co., Boston, Mass.

LARGE MACHINE SHOP TO BE ERECTED.

Extensive expenditures are being planned by the Canadian Pacific Railway for Moose Jaw, Assa., and immediate vicinity, amounting to a total of over half a million dollars. Plans are under way for the erection of a large machine shop. It will be located adjacent to the roundhouse, and will be thoroughly equipped throughout. Another addition to the company's works at that place will be an air plant for testing all locomotives and cars to insure the proper operation of the air brake attachments.

ENDURANCE OF FANS.

Some interesting facts regarding the endurance of a centrifugal fan blower were brought out in the discussion at the last meeting of the Pittsburg Foundrymen's Association, regarding the relative merits of the positive blower and the fan. It was stated by a representative of the Westinghouse Air Brake Co., that they installed six positive blowers in their foundry, and after six months replaced them with fans. At this plant the iron is melted continuously and the blowers were compelled to operate 23 hours daily. The blowers were operated at a pressure of 16 ounces and at the beginning of a heat would run up to 20 ounces. Regarding the life of fans, he said that they have used a No. 9 fan for 15 years, and during that period it was operated 23 hours every day, except Sunday, and required no repairs whatever.

CANADIAN FAIRBANKS CO.

THE most important move in machinery circles within the month has been the establishment of the Canadian Fairbanks Co., with Mr. H. J. Fuller as president. During the past six years this company has built up a monster business in Canada. The Fairbanks Co. did not see their way clear to manufacture in Canada, so that Mr. Fuller offered to buy the business in order to organize it as a Canadian firm. It has been arranged that the business will be conducted, on and after March 15th, as The Canadian Fairbanks Co., Limited, Mr. Fuller being president and treasurer. It is his intention to erect a large plant for manufacturing in Canada the specialties which they have heretofore imported.

The first move will be to remove the Montreal warehouse into new quarters at 444-446 St. James street on the first of May next, the old quarters on Craig street being also retained, as the extra space will be needed for the increase of business.

The new company will continue to represent the following companies: The American Tool Works Co., Cincinnati, O.; the American Wood Working Machinery Co., New York City; the American Spiral Pipe Works, Chicago, Ill.; the American Steam Gauge & Valve Co., Boston, Mass.; the Buhl Malleable Co., Detroit, Mich.; the Brown & Sharpe Manufacturing Co., Providence, R.I.; the Bignall & Keeler Manufacturing Co., Edwardsville, Ill.; Messrs. H. A. Cole & Co., Liverpool, England; the Emmert Manufacturing Co., Waynesboro, Pa.; the Foster Engineering Co., Newark, N.J.; the E. M. Dart Manufacturing Co., Providence, R.I.; the Goubert Manufacturing Co., New York City; the H. W. Johns-Manville Co., New York City; the Johns-Pratt Co., Hartford, Conn.; J. J. McCabe, New York City; the Niles-Bement-Pond Co., New York City; the Norton Emery Wheel Co., Worcester, Mass.; the Oneida Steel Pulley Co., Oneida, N.Y.; the Oster Manufacturing Co., Cleveland, O.; the G. M. Parks Co., Fitchburg, Mass.; the Wm. Rutherford & Sons Co., Montreal, Quebec; Messrs. Randolph-Clowes Co., Waterbury, Conn.; the Reed Manufacturing Co., Erie, Pa.; the Reliance Machine Tool Co., Cleveland, O.; the Riehle Bros.' Testing Machine Co., Philadelphia, Pa.; the Taunton Loco. & Manufacturing Co., Taunton, Mass.; Messrs. J. B. Treasure & Co., Liverpool, England; the Warner Instrument Co., Beloit, Wis.; the Union Manufacturing Co. (Chuck Dept.), New Britain, Conn.; the S. A. Woods Machine Co., Boston, Mass.; the T. B. Woods' Sons Co., Chambersburg, Pa.; Messrs. Wilmarth & Morman Co., Grand Rapids, Mich.; the Warnock Manufacturing Co., Worcester, Mass.

PERSONAL MENTION.

AMONG the organizers of the Rio de Janeiro Tramway Light and Power Co., with a capital of $25,000,000 are Sir Wm. Van Horne of Montreal, Wm. Mackenzie, R. R. Wood and Z. A. Lash of Toronto. The object of the company is to develop a great water power near Rio de Janeiro, and to transmit electric current for lighting, street railways and industrial purposes. This promises to be the largest electrical undertaking in the world outside of Canada.

Mr. R. H. Stewart has succeeded E. B. Kirby as superintendent of the War Eagle and Centre Star mines at Rossland.

Mr. W. F. Ireland, on leaving the Massey-Harris offices in Toronto to accept a position with the Sawyer-Massey Company in Hamilton, was presented with a handsome locket and chain by his associates.

Mr. Frederic Nicholls, vice-president of the Dominion Iron & Steel Company, has returned to Toronto from a trip to Sydney. He reports Mr. Plummer, president of the company, to be rapidly regaining his health.

Hon. Mr. Emmerson, Minister of Railways, stated in Parliament last week that the officials of the Intercolonial Railway had reported that so far as their experience went the steel rails manufactured in Canada were certainly equal to any which have been imported. The sum of $100,000 has been voted for double tracking the Intercolonial.

Mr. Thomas Gibson, director of the Bureau of Mines for Ontario, has received a request from large manufacturers in New York for information regarding the supply of molybdenite in Ontario, they desiring to use the metal in the manufacture of tool steels. There are extensive deposits of this metal in Ontario, but none of the mines are developed as yet.

Mr. Frank Parks, bookkeeper for the Canada Screw Company for a number of years, who is leaving for Brandon to accept a position with the Bell Organ Company, was presented with a handsome gold watch and chain recently at the Gore Street Methodist Sunday School, in recognition of his services as secretary of the Sunday School orchestra.

Mr. Wm. J. Allison, of New York, who has become very wealthy in New York through a clerkship long held with the Vanderbilts, is about to locate a monster steel and tin plate works on the Canadian side at Morrisburg. Mr. Allison has purchased Dry Island at the foot of Galops Rapids in the St. Lawrence River, and is having a palatial summer home built thereon to be near the works.

Mr. D. R. Noonan, Perth, Ont., is retiring from business and has disposed of his trade to the new firm, Noonan & Ferrier, for whom is bespoken an increased implement trade. D. R. Noonan has been before the public in active and successful business for 30 years and is one of the best known men in the district. He is a firm believer of Dr. Osler's 60-year theory—not the chloroform joke, though—that men should retire from active life at 60.

The seventh annual meeting of the Ontario Wind, Engine and Pump Co. was held on Tuesday at the King Edward Hotel. The progress and welfare of the company was discussed, after which a dinner was given to the visiting representatives. In the evening, Mr. F. W. Monteith, the retiring sales manager, was presented with a roll-top desk, an office chair, and a gold chain by the firm, and with a gold watch by the office, traveling and mechanical department.

Mr. Thomas J. Mullin, superintendent of construction for Allis-Chalmers-Bullock, Limited, Montreal, who was married in Cincinnati on Wednesday, was tendered a farewell dinner at the Engineers' Club, Saturday evening, by the staff af the head office. The chair was occupied by Mr. Alfred Collyer, and among those present was Mr. George Berg, manager of the Boston office of the Allis-Chalmers Company. During the evening Mr. Mullin was presented with a handsome set of carvers, and was also the recipient of a number of congratulatory telegrams from different parts of the country.

Mr. N. V. Leech, of London, Eng., a director of the Cape Breton Iron and Railway Company, has arrived at Glace Bay, N. S., accompanied by Mr. P. F. Thomas, who will be resident manager of the company. Two miles of survey have been completed from Broughton, where the company's mine is situated, toward Sydney, on the proposed railway. Three mining machines are now in use in the pit and more will be added in the Spring. Work on a third slope will be in operation when the mine is in full running order. Mr. Horace Mayhew, the English coal baron, is president of this new company, which proposes to carry on large operations.

Recent Development in Prime Movers.

At the beginning of the present century there loomed up upon the horizon of modern industrial progress two forms of prime movers—the steam turbine and the gas engine—which were widely heralded as destined to displace the steam engine in its general application to the generation of power. At the end of the five years intervening it is instructive to look back over the progress which has been made, and to observe in what measure predictions have been fulfilled.

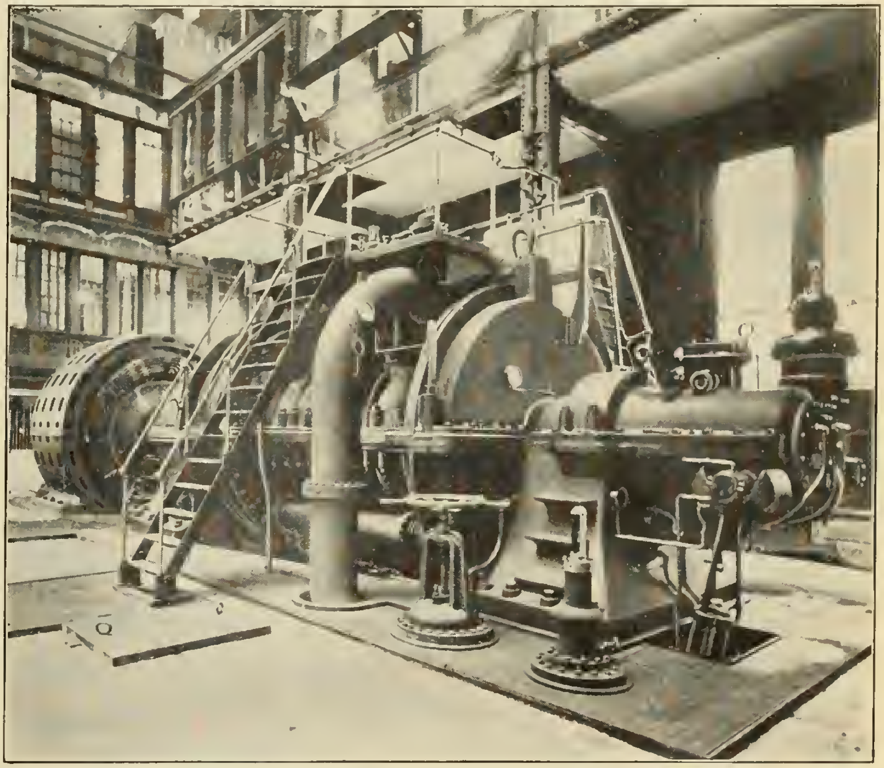
It is not proper to take the view of some pessimists who seem sadly disappointed because these have not been fulfilled to the letter regarding the immediate displacement of the steam engine, and it is only necessary to reflect that true progress is not of revolutionary character but is based upon the gradual change which is consequent upon the education of the public in the new line of progress. If we were to illustrate diagrammatically, side by side, the present status of each form of prime mover we should find the steam engine still so far in the ascendancy as to momentarily raise the question whether other forms of prime movers had made any progress at all, but by similarly comparing the rate which has characterized the advancement of the steam engine in the last five years with that of the turbine and gas engine, we are surprised to find that the steam engine has been left far behind in the race.

One of the greatest difficulties in introducing any new process or machine is the blind conservatism of those who preserve a stolid indifference to either argument or evidence. Such has been the case in the introduction of the steam turbine and gas engine owing to the revolution in the application of Nature's forces and the laws of mechanics in the two new types of motors. That this ultra-conservative opposition to progress should have arisen can only find explanation in the long period during which the steam engine has held undisputed sway.

To one who has followed closely the fortunes and misfortunes of the struggle it must be admitted that conservatism has finally been broken down, and that the two new motors have finally obtained the desired recognition. A few striking instances will suffice to supplement statement by evidence:

About four years ago the great generating station of the Manhattan Railway Company of New York was completed, and represented at that time the acme of engineering achievement. The type of prime mover employed and the size of the units, each of which was 5,000 kw. capacity, reflected the tendency of the times, which was unmistakably toward larger powers and more compact generating units. There were eight of these units first installed with sufficient space left for the ninth, when the extra power should be required. These requirements have already arisen, and the extra unit is now in place. It is not of the old type, but rather of the turbo type, and the interested observer who strolls through the Manhattan station and finds at the end of the long aisle of massive generating units a new machine of diminutive size is inclined to reflect as to what has brought about the change. It is to be taken for granted that a public corporation of such magnitude as the Manhattan Railway industry, with such important public service as that of transportation, would not knowingly hazard the excellence of its service by the adoption of an untried form of prime mover.

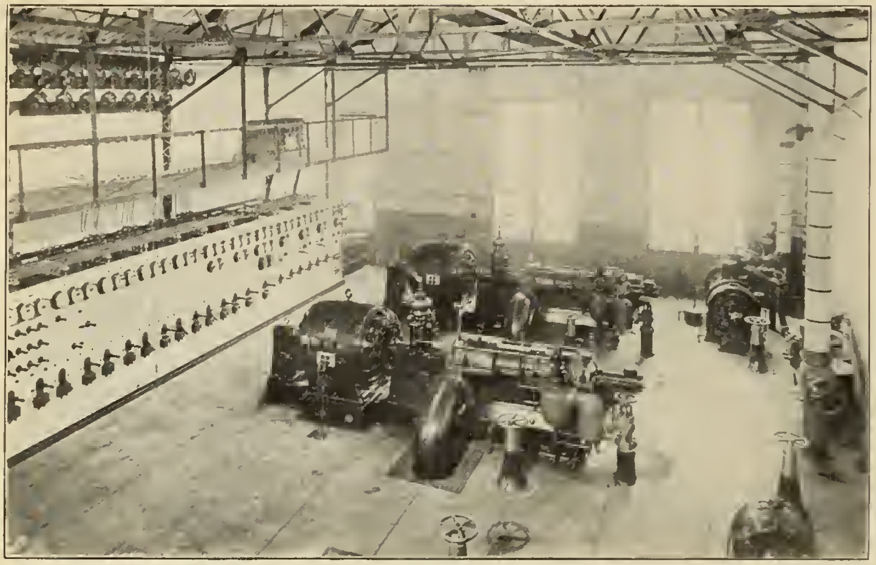
Looking further into the projects which are now undergoing completion or development in the great metropolis, we find still more unmistakable evidences that the steam turbine is a fact, not a fancy. We find that the great Pennsylvania terminal improvement undertaking will ultimately depend wholly upon a steam turbine-driven power plant for its supply of electricity for operating its electrically-propelled trains and for lighting its tunnels, stations, etc.; also that the electrification of the New York Central terminal system will involve the construction of an exclusively driven turbine plant. In Philadelphia the underground system now under construction will be operated from a turbine-driven central station, eventually containing ten 5,500 kw. turbine units. Similarly in London the Metropolitan Railways properties have been completely electrified and derive their power from turbine-driven stations. Do these facts savor of progress or de-



7,500 H. P. Westinghouse-Parsons Steam Turbine Generator Unit.

cadence, particularly when all has been accomplished within little more than five years?

Why is it that the turbine has secured so strong a foothold in modern power work? Simple observation shows it to be much more compact than any form of steam engine. We reflect that this



Steam Turbine Driven Central Station.

compactness insures a considerable reduction in the initial cost of a power station, due to saving in land and buildings. We know that the foundation material required is small, due to the fact that there are no reciprocating stresses to be absorbed, even to the extent that no foundation bolts are required to hold the turbine in position. We have been somewhat skeptical of the commercial value of high vacuum, principally because of the refinement of apparatus necessary to secure such, but we now know from tests that under most conditions high vacuum is commercially profitable. As to comparative cost of power station construction, we learn from turbine users that the cost of the building of turbine plants is not greater, and usually less, than that of the engine plant, particularly where the power plant has been designed primarily for the use of steam turbines.

But we must look further than this to obtain a broad conception of the commercial economy of steam turbines. What may be called the personal equation of the power plant is distinctly involved. A superintendent alive to the conditions which will secure the highest commercial efficiency in his plant would hesitate to place the plant in charge of unskilled labor. Although the plant might run itself for a time, he would anticipate and eventually experience its rapid deterioration. Instead, he would attempt to organize the most efficient operating force within his power, realizing that proper upkeep of his equipment was vitally necessary. And if this precaution applies to plants employing reciprocating engines, it should even more apply to steam turbine plants; yet it is a fact that some of the early applications of steam turbines in this country have been engineered and operated in a way that would incur certain destruction of an engine plant. The operatives, after a short acquaintance with "the newfangled thing," have come to the conclusion that the turbine will operate best by itself and have, either through the exigencies of the service or through negligence, failed to make such periodical inspection as should obviously be given any piece of fine machinery. The designs of many plants have been faulty in the provision of means for controlling superheat and for guarding against water in the turbine, either from the steam or the condenser end. Yet, in spite of these lamentable operative conditions, the turbine has survived with the sobriquet "fool proof."

It is to the operative side of the plant that we may therefore look for the most effective competition with the steam engine. On turbine units both the construction and operation are simple to a degree not possessed by any other engine, with perhaps the exception of the hydraulic turbine. Being entirely self-contained and having no rubbing parts except the bearings, it may be maintained at constant efficiency with very little supervision and inspection. Its high rotative inertia exerts an important corrective influence on the regulation of the service, and the ease with which it may be synchronized and operated in parallel with other alternating current generating units, either engine or turbine, constitutes one of its most valuable features. The trend of modern progress in electrical power developments is unmistakably toward alternating current generation and distribution of power, and it is in this field that the turbine has found particularly rapid application.

It is not the intention to dwell here upon the designs of modern forms of steam turbines, these having been presented in detail in the engineering press. It is, on the other hand, intended simply to convey a broader impression of the progress which has been made than is

Westinghouse Double Acting Tandem Gas Engine.

customarily accorded the turbine by those who have not had the fortune to be personally acquainted with its less conspicuous features. When we reflect that the largest power stations in the world now under construction are to be equipped with steam turbines, and that their construction is being taken up by

numerous builders of engineering apparatus, both at home and abroad, we are compelled to admit that a revolution in power applications is indeed a reality.

But what of the other form of motor —the internal combustion engine? Has it kept pace with turbine progress? When all the conditions affecting its use are taken into consideration it is safe to say that a commensurate progress has been recorded. We have ample evidence that the efficiency of the gas engine is higher than any form of heat engine. The best modern steam engine barely approaches 20 per cent. efficiency in the ratio of energy delivered to the piston to heat energy input through the steam pipe. Based upon useful horse-power delivered at the shaft, this efficiency is more nearly 15 per cent. The efficiency of some forms of steam turbines, based upon brake horse-power, is 20 per cent. The heat consumption of the ordinary power plant engine may be considered to approximate 10 per cent. On the other hand, a very average efficiency of high-grade gas engines is 25 per cent., and with special designs over 30 per cent. may be obtained.

But, we are asked, if the combustion engine is so highly efficient, why has it not entirely displaced the steam engine? There are two reasons, neither of which can be laid at its door as a functionary shortcoming:

Firstly, on account of its high efficiency its early applications have been logically centred in those sections where the cost of fuel was high, and some of the more conspicuous installations in domestic territory are therefore to be found in remote sections, such as South-West Mexico and South America. In Europe, where this type of engine is now used to a surprising extent, the extremely high cost of fuel has furnished the main incentive toward its development. Further, by reason of the smaller earning capacity of European properties and the consequent necessity of utmost curtailment of expense, its high economy has been the most important factor in bringing about its general introduction. In America, the general industrial conditions have been distinctly reversed: coal has been abundant and cheap, labor the opposite. And it is thus that the merits of the combustion engine have not been brought home to us with such direct forcefulness. With plentiful stores of energy at hand, previously bottled up by Nature for our uses, we have not been in need, until recent years, of the more efficient prime mover.

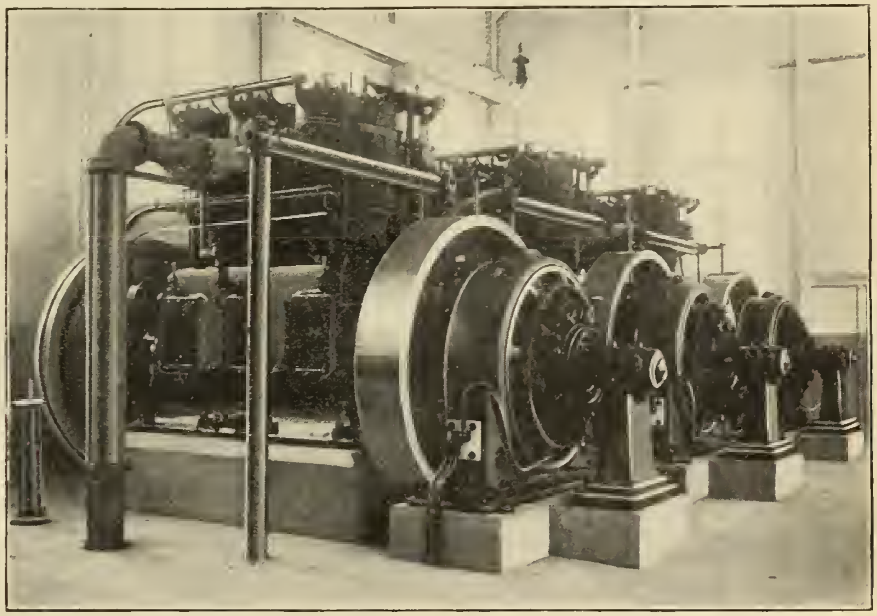
Secondly, when the introduction of the gas engine had been begun by a handful of enterprising American manufacturers, serious difficulty arose in the provision of a proper fuel. In sections where natural gas was plentiful, the difficulty was solved, and numerous power plants are now running upon natural gas drawn from private wells or from those of the distributing company. In other districts, however, coal gas or producer gas has been the only alternative. The former is far too expensive for general power use; the latter has only been generally successful when produced from anthracite coal. This, even at the present time, constitutes the most serious problem in the application of gas-power.

As an exception to the above may be mentioned the Mond Ammonia Recovery process, in which bituminous coal is used successfully, large quantities of ammonia being reclaimed in the form of ammonia sulphate. The chemical process, however, adds complication to an otherwise simple system, and is hardly applicable to general development of small powers. There is now under construction in England a large gas distribution system which will supply Mond gas in great quantities to all towns in the South Staffordshire district within an area of 123 miles.

There are several builders in this country and numerous ones abroad who are ready to construct engines, but they must be supplied with producer gas made from bituminous coal by a process embodying the essential requirements of extreme simplicity and economy. When such a process is available, another revolution in choice of prime movers is certain.

Probably the most important development and achievement in recent gas-power engineering has been the conservation of waste products from blast furnaces, coke ovens, etc. The practice was started in Germany, and has now been extensively adopted in America, a prominent example being a large installation of blast furnace gas engines at the Buffalo plant of the Lackawanna Iron & Steel Co. Similarly the rich gases given off during the process of coke making are being transformed into power through the medium of gas engines. In one instance of a large American oil refinery the rich gases distilled off during the refinement of crude petroleum are similarly conserved for use in gas engines for generating light and power. In districts where natural gas is available, gas engines are largely used in several central stations, using this fuel for its service. Producer gas, of course, offers the greatest field for development, and much progress has already been made. A number of stations in American territory are now operating on this fuel, notably one at New Haven, Conn., and another at San Luis Potosi, Mexico.

The last census furnishes some instructive data relating to comparative progress of the gas engine. During the


125 H. P. Gas Engines Direct Connected to D. C. Generators.

preceding decade the capacity of steam power applied to manufactories increased 91 per cent., that of gas power 1,511 per cent.

In Europe gas engine progress has been distinctly favored by local operating conditions, as above pointed out, and several builders are turning out engines of 1,000 to 4,000 horse-power capacity. An eminent English authority, Mr. H. A. Humphrey, estimated at the close of 1902 that there were in operation or had then been built engines aggregating 182,000 horse-power; this estimate excluded all engines under 200 horse-power, and the average was therefore about 550 horse-power per engine. Conservative estimates would now nearly double these figures, and indicate an advancement in a comparatively new industry which has not generally been appreciated.

MACHINE SHOP VENTILATION.

The absolute necessity for providing an adequate system of ventilation of public buildings is being recognized more and more each year; and as a consequence more attention is being paid to it. If it is necessary that public buildings have a good ventilating system, how much more is it necessary that a workshop, where the workmen spend so many hours of the day should have a good system. Fresh air is necessary to maintain the bodily vigor and alertness of the workmen. If instead of fresh air they breathe over and over again the same air, they will become exhausted and lose interest in their work. This good ventilation of shops is not only necessary to the health of the workmen, but it is also a source of economy, since the men keep the vigor necessary to perform their work with alertness and enthusiasm throughout the whole day.

Then, of course, in Winter the shops have to be heated, and to secure the best system of heating and ventilating, one should depend on the other; that is, the system should be a combined system of heating and ventilating. A few words regarding the placement of the fresh air inlet and the foul air outlet, and best way of heating the air for the shops would not be out of place.

The air, as it is expelled from a person's lungs, is warmer than the surrounding air, and, therefore, tends to rise. However, since this air is laden with impurities, such as carbon dioxide, it is at the same temperature heavier than ordinary fresh air. Now, the air is expelled from the nostrils in a downward direction, and, therefore, will continue in that direction for a certain time, and at the same time is being rapidly cooled to the temperature of the surrounding air. Therefore, by the time its downward velocity is overcome, and its lightness has asserted itself and it begins to rise, in all probability it will have been cooled to the temperature of the room, and will again begin to fall.

From this consideration it would prove the best policy to have the foul air outlets near the floor, provided that a current of cold air is not entering at the floor, and there were a draft created. The necessity for this provision is quite evident, since the cold air is heavier than the impure air at the ordinary temperature of the room and, consequently, if both the cold air inlet and the foul air outlet were at the floor, and there were a draft created, the outlet would not be a foul air outlet at all, but a cold air outlet, since the cold air would form a steady stream from inlet to outlet.

If the outlet is to be at the floor, the inlet should be half way up the wall of the shop, where a draft should be created; perhaps the best way for an ordinary machine shop being by use of a fan. Then to consider the heating problem, it is very desirable, both from the heating and from ventilation standpoint, that the air as it enters should be raised to a certain temperature, not necessarily to the temperature desired for the shop, but high enough so that its heaviness will not cause it at once to drop to the floor. This heating can be done by having the air as it enters pass through a set of steam or hot water coils. After the air has entered it may be raised to the desired temperature for working in by direct radiation from steam or hot water pipes.

For very apparent reasons it is much more desirable that the pipes be some distance from the floor in a machine shop. The best of these reasons is that the tools are generally arranged near the windows and, therefore, near the wall, and if there were a row of steam or hot water pipes along the wall next the floor it would not be very comfortable for the operators of these machines.

In arranging a heating and ventilating system in a machine shop it is only necessary that a few of the common laws of ventilating should be followed, and that good commonsense is displayed in the arrangement of the system, so that one good point may not be spoiled by the application of another which does not suit the system being carried out.

BOOK REVIEWS.

The Mechanical Engineer's Reference Book, a hand-book of tables, formulas and methods for engineers' students, by Henry Harrison Supler, B.Sc., M.E.; J. B. Lippincott Company, publishers, Philadelphia; $5.00 net. This book is a valuable addition to the engineering hand-book in use to-day. It contains 823 pages, half of which are devoted to mathematics, mechanics' materials of engineering and strength of materials. In this the metric tables and conversion of metric to English units, is an important item. In the latter half of the book, departments are assigned to machine design, heat, air, water, fuel, steam, steam boilers, steam engines, internal combustion motors, electric power, the cost of power and works management, and these contain considerable new data on the subjects mentioned.

* * *

The Steam and Gas-Fitter's Price Book—The Plumber's Price Book, by Schuyler C. Brown: Perfect Manufacturing Co., Saratoga Springs, N.Y.; $3.00 net.

An illustrated compilation of all the fittings used by steam and gas-fitters and plumbers, with prices of the different sizes used, from ¼ up to 6 inches, including list price and at discounts from 40 to 70 per cent. for certain lines. For each class blank spaces are left for cost price, trade and selling price, to be filled in according to the prices in different localities. As a handy book for the office of those interested, this book should commend itself at once.

* * *

Steam Turbines, with an appendix on Gas Turbines and the future of Heat Engines, by Dr. A. Stodola: D. Van Nostrand Company, publishers, New York; $4.50 net.

This is the English translation by Dr. Louis C. Loewenstein, of Prof. Stodola's work, which is now considered the standard authority on the subject in Europe. In the original, the metric units were used exclusively, but the important results of experiments have been recalculated for the English system. It treats mathematically the elementary and thermodynamic theory of the steam turbine, the construction of the most important turbine parts; steam turbine types; takes up special problems of steam turbines and the future of the heat engine.

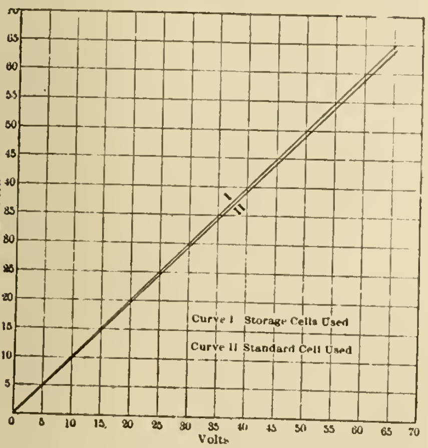
Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

CALIBRATION OF VOLTMETERS AND AMMETERS.

THE following method of calibrating a voltmeter is due to Professor W. S. Franklin, of Lehigh University. The curves given are taken from the laboratory reports of students of Delaware College. The method really tests the proportionality of the scale of the voltmeter, which, being known, the calibration curve can be plotted; one point on the curve being obtained by means of the well-known method of potentiometer and standard cell.

A storage battery of enough cells to cover the range of the voltmeter furnishes an excellent source of e.m.f. The voltage of each cell is first taken and recorded. This gives a relative measure of the voltage of each cell. The voltages of each cell are nearly equal, consequently the deflections will differ very slightly. Thus, an error in the scale of the voltmeter will introduce almost no error in the relative e.m.f.'s of the different cells. The deflection due to two cells in series is then recorded, three cells in series, etc., until all the cells have been put in series and the readings taken. The preceding results are then sufficient to test the proportionality of the scale markings on the voltmeter. The above outline is rendered very much clearer when a particular case is discussed.



Calibration of Voltmeter.

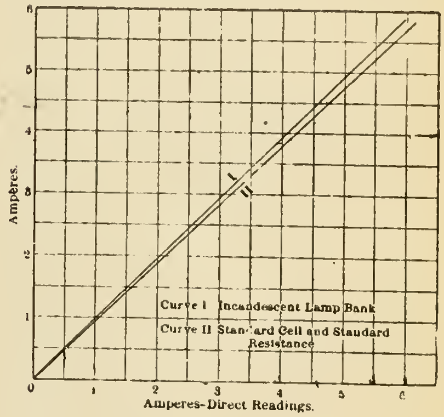
Fig. 1 is the calibration curve for a portable Weston voltmeter having two scales, 150 volts and three volts. The voltage of each of 32 storage cells was read directly on the three-volt scale. This is done quickly and easily by having the wires from the voltmeter terminate in two sharp points, which are pressed into the lead plates to make good contact. For the second case, where the voltages of the cells in series are taken, the voltages are read directly on the 150 volt scale.

A curve is plotted in which the abscissae are the readings obtained with the different cells in series and the ordinates are the corresponding sums of individual voltages. For instance, the sum of the voltages of cells No. 1 and No. 2 (4.16 volts) is the ordinate of one point on the curve and the reading with cells No. 1 and No. 2 in series is the corresponding abscissa. It is evidently unnecessary that the ratio of the two scales (150 to 3) should be exact. If the readings are proportional to the voltages, the curve will be a straight line. Any deviation in the proportionality of the scale will cause a departure from the straight line. Curve No. 1 of Fig. 1 was obtained by plotting the above values. The points all lie on a straight line within the limits to which it is possible to read the voltmeter. This is true on all of the Weston instruments which have been tested. The use of the double scale does not introduce an error, since the same deflection always corresponds to the same current through the movable coil of the voltmeter independent of the scale used.

Curve No. 2 of Fig. 1 is obtained by checking up a point " A " on the high scale of the voltmeter, against a standard cell by means of a potentiometer. A straight line through this point from the origin can now be drawn, giving the calibration curve, in which ordinates are true volts and abscissae the readings. Curve No. 1 shows that a straight line is allowable. In case curve No. 1 should not be a straight line, curve No. 1 is rotated about the origin as a centre until curve No. 1 passes through the point A. The new position of curve No. 1 is then the calibration curve for the instrument. One way of easily accomplishing this is to plot curve No. 1 on a separate sheet of thin cross-section paper, superpose the two sheets and prick the points through the paper.

The readings of the voltmeter must be corrected for " zero error," otherwise the calibration curves will pass to the right or left of the origin corresponding to the error.

The same principle for calibrating a voltmeter has been applied by the writer to the calibration of an ammeter. A bank of lamps, or a number of rheostats, if larger currents are desired, are connected in parallel with mains which are held at a constant voltage. The current taken by each lamp, or resistance



Calibration of Ammeter.

unit, is first measured on the instrument to be calibrated. Then the current taken by two lamps in parallel, three lamps in parallel, etc., is measured. This tests the proportionality of the scale divisions in a similar manner to the voltmeter calibration.

Fig. 2 is the calibration curve for a double-scale (15-amp and 3-amp) Weston portable ammeter calibrated in this manner. A couple of 16-cp, 110-volt lamp banks were used as resistance units. As the voltage of the storage battery was only 60 volts, two or three lamps in parallel were used as resistance units, thus giving approximately half-ampere steps. A voltmeter is connected across the lamps and a rheostat in series with the line, in order to maintain the voltage constant. A small

water rheostat with movable plates gives good regulation of the voltage. From the results of the test the current taken by the first resistance unit (three lamps) is 0.550 amp. The current taken by the second resistance unit (three lamps) is 0.575 amp. The reading with the two resistance units in parallel is 1.14 amp., and should agree with the sum of the currents (0.550 plus 0.575 equals 1.125 amp.) taken by the two resistance units. The low scale (3-amp.) was used to measure the individual currents, and the high scale (15-amp.) was used with the different combinations of lamps in parallel. As with the voltmeter calibration the ratio of the two scales need not be known, provided it is constant. The absolute current corresponding to one reading is obtained by balancing the e.m.f. of a standard cell against the drop through a standard resistance, thus giving one point on curve No. 2. A straight line is drawn through this point and the origin. If curve No. 1 is not a straight line, it is rotated about the origin as a center until the curve intersects the point determined by a standard cell.—Electrical World an Engineer.

TENDENCIES IN CENTRAL STATION DESIGN.

IN considering the subject of present tendencies in central station design, it seems very evident that a matter for just consideration is the design of the boiler room upon advanced lines. Until quite recently this portion of the plant has usually been given scant attention, almost anything being good enough. This precedent thus established by the designer has been followed by the attendants in charge, who have neglected it. At the same time, a wealth of brains and energy has been devoted to the engine and generator rooms, and to methods of distribution. Of late there has been a growing tendency to change this situation, due, no doubt, to a tardy realization that marked economies are possible with a well-designed boiler room.

Among the features most worthy of encouragement are:

1. A better understanding of the possibilities and limitations of automatic stocking.

2. Automatic fuel and ash-handling apparatus, and fuel storage.

3. Higher pressure boilers with superheaters.

4. A realization of the fact that smoke-making always means fuel waste.

5. A better understanding and appreciation of benefits of economizers and mechanical draught, the latter particularly where sudden and severe overloads must be cared for.

6. The elimination of scale, oil and other impurities from the boilers.

Other details which are having intelligent study and which promise profitable results are:

7. The use of briquettes made from inferior and waste fuels.

8. Methods for the use of powdered fuel.

Accompanying all this is a better understanding of the detailed and convenient arrangement of boiler-room apparatus, and better provision for easy access to all parts, together with improved light and ventilation.

Another direction in which there appears to be a tendency toward development, is the increased and more intelligent use of exhaust steam for heating, and other by-processes, and a realization of the fact that condensing engines may be operated profitably in connection with heating systems, with advantage both to the engine and to the heating system.—Electrical Review.

PATENT ABSORPTION DYNAMOMETER.

A NEW and simple dynamometer has recently been made. It is especially suitable for measuring the brake-horse-power of electric and petroleum motors, and has a range of from ¼ to 20 horse-power. The power is absorbed by revolving vanes in air. Vanes of three different sizes are supplied, and the apparatus can be clamped on spindles from ¼ in. to 1⅛ in. diameter. The dynamometer is compact and simple, and goes into a box 24 in. by 9½ in. by 6 in.; the weight complete, including the box, is about 22 lbs. The essential feature of the dynamometer is the simplicity and quickness with which the brake-horse-power can be obtained. It has been calibrated for speeds up to 2,000 r.p.m. The dynamometer is clamped on the spindle of the machine to be tested, and the vanes are adjusted to such a radial position that the motor runs at the required speed when under load. Knowing the speed, and the position and size of the vanes, the horse-power can be immediately obtained from the calibrated results which are supplied with the dynamometer.—Eng. Rev.

THE FUTURE OF RAILWAYS.

STATISTICS show that the mileage of steam railways, and the capital invested in them has increased very greatly during the last thirty years, the percentage of net receipts to total paid-up capital has steadily decreased, and the percentage of working expenses to gross receipts has, on the contrary, increased. Regarding the engineering of the purely mechanical portion of the problem of substituting electric for steam traction, it is altogether feasible, but this is not the one to be solved or the one which is having serious consideration of practical engineers. It is a question of paying larger dividends on invested capital.

The work of railway companies is subdivided into four classes: First, long distance main line service, which may be characterized as service with runs of fifty or more miles without stopping, and connecting such places as London and Brighton and London and Liverpool; second, freight traffic involving the use of long and heavy trains having to haul considerable distances at a comparatively slow rate of speed; third, suburban passenger service, connecting the suburbs of the large cities with centres of business; fourth, local or branch lines, connecting the small country towns on the through main lines to off-lying market centres.

As regards the long-distance main line service and the freight traffic, it is held that there is no advantage to be gained by superseding steam locomotives. In the case of countries having large water powers which can be utilized at not too great a cost for driving electrical machinery, or where coal is very expensive, the case might be different. Considering the last two categories, the case is different, and there appears to be little doubt that, by using improved methods of locomotion and methods of haulage for suburban and for branch lines, not only could working expenses be considerably reduced, but also the gross receipts could be considerably increased. As regards suburban traffic, it seems that electric traction is the only means of dealing with it; whereas, with branch line service, it appears more probable that motor cars driven by some motive power other than steam, may be applied with very beneficial results.—Electrical Review.

DEVELOPMENT OF THE UNIPOLAR DYNAMO.

PROF. MICHAEL FARADAY, of London, in 1831, constructed the first unipolar dynamo. It was quite similar in appearance to Barlow & Sturgeon's unipolar electric motor, which had been invented a few years previously. Faraday's machine consisted in a circular plate of copper mounted in a horizontal shaft between the links of a U-shaped permanent magnet. One wire was flattened at the end and pressed against the circumference of the circular plate armature, while another wire pressed against the shaft. The points of contact of the wire were

amalgamated. On mechanically rotating the armature there was generated an electromotive force which caused a current to flow either from the centre to the circumference of the armature or the reverse, according to the direction of rotation of the disc. The presence of the current was made manifest by means of a galvanometer.

Werner Siemens devised and constructed a unipolar dynamo which consisted of a horizontal U electromagnet, round the poles of which two hollow cylinders of copper were caused to rotate by means of belting or gearing. A second field magnet having pole extensions lay between the limbs of this magnet.

Delafield designed a machine somewhat similar to that of Siemens. But in this machine the copper cylinders were not divided into sections. The electro-magnetic structure formed a consequent pole within each copper armature.

Prof. Galileo Ferraris, of Turin, Italy, invented a unipolar dynamo in which two electro-magnets lay end to end with their similar poles in contact with each other. Within a cavity extending across the upper surface of the upper pole was the lower part of the armature. Within a similar cavity extending across the lower surface of the lower pole was another armature. The lines of force passed along the two shafts during part of their course.

Prof. George Forbes, of Glasgow, invented an iron-clad unipolar dynamo. A solid iron cylinder six by nine inches in dimensions rotated within a thick hollow iron cylinder by which it was entirely enclosed. Two magnetizing coils were wound in grooves in the casting. This machine yielded thousands of amperes of current but the pressure was only about two volts.

Prof. Crocker, of Columbia University, New York, in conjunction with Mr. Parmly, invented a unipolar dynamo. This consisted of two large annular electro-magnets standing near each other in parallel vertical planes. The opposite poles of each electro-magnet were very near each other. A large thin iron ring rotated with its ends in the fields of the annular field magnets. The ring constituted the armature from which the enormous current was led off by means of brushes at various points of the whole circumference.

Nikola Tesla devised a unipolar dynamo consisting of two U field magnets, having opposite circular poles near each other. Thus there were two magnetic fields. Within each magnetic field a disc armature was mechanically rotated. Other unipolar dynamos were built and designed by Heath and Wadsworth, each of which embodied interesting features.

Polecho's unipolar dynamo consists of a metallic disc slit radially into many sections. Two field magnets are used. Each stands diametrically opposite the other. Between the opposite poles of each field magnet the disc armature rotates. A hoop surrounds the thickened outer edge of the armature. Brushes press against the hoop in order to convey the electric current. Lord Kelvin invented a machine similar to this. The unipolar dynamo yields an enormous amperage of perfectly steady value. It is simple. Its first cost is low. It occupies little space. On the other hand it yields but a low voltage It must be driven at very high speeds, and there is difficulty in taking off the current from the rapidly moving armature. Numerous brushes are required. These are subject to considerable heating and wear, and the loss of power through torque of friction is considerable. For direct connection to steam turbines of high peripheral speeds, the unipolar dynamo possesses characteristics which seem to render it suitable to certain classes of work where there is required a large current at low voltage such as in numerous electrolytic processes.

THE TELEGRAPHIC TRANSMISSION OF PHOTOGRAPHS.

Many more or less successful attempts have been made in recent years to devise a method of reproducing photographs, drawings, and handwriting at a distance by means of electricity. The selenium cell, the action of light upon which diminishes or increases its resisting properties, afforded a ready means of transmitting fluctuations in the intensity of a source of illumination, and of converting these differences of light intensity into the oscillations of an electric current. If, for example, a beam of light and a selenium cell be simultaneously passed over the opposite surfaces of a photographic negative, varying degrees of opacity of the plate will set up corresponding oscillations of the current in the circuit of the cell. This is the common feature of all the transmitting devices hitherto suggested.

The current oscillations are made to act on a receiving apparatus which will convert them into fluctuations of light intensity. The design of the receiving apparatus has, however, so far been the weak point in all these systems, because the electric currents transmitted are so very feeble. Furthermore, the synchronous working of the transmitting and receiving apparatus has been a source of difficulty, and but imperfectly secured in previous forms of apparatus. This does not, however, appear to be the case with the teleoptical system of Prof. Arthur Korn, of Munich, whose success is due principally to the employment of a vacuum tube as an adjustable source of light at the receiving station.

While engaged in investigating the radiations given off by the electrodes of the vacuum tube exhausted to a pressure ranging between 0.2 and 2 millimeters, Prof. Korn noticed, as Hertzian vibrations were applied to the electrode, the extreme sensitiveness with which these radiations would react on small alterations in the circuit. The sensitiveness suggested a possible utilization of those radiations which were photographically most efficient, in connection with a method of electrical telephotography.

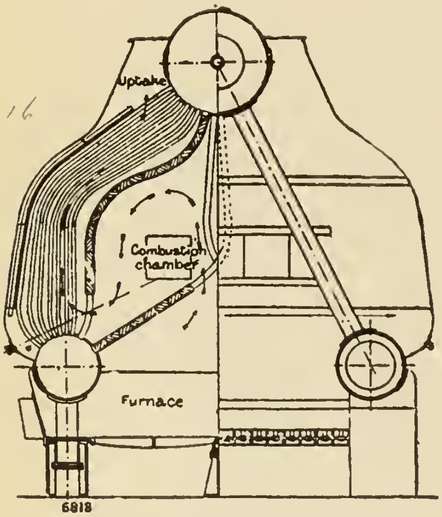
In the apparatus a sensitive photographic film wound round the cylinder of the receiver rotates in front of a small opening in the vacuum tube, the surface of which is coated with black paper and tin-foil. By means of high frequency currents luminous radiations are produced inside the tube which after passing through the small opening, act on the sensitive film in a spiral line exactly like the stylus of a phonograph. The roller is moved synchronously with the glass cylinder of the sending apparatus on which is wound a film bearing the photograph to be transmitted on which is directed a concentrated beam of light from a Nernst lamp. The beam of light penetrates the film and strikes a selenium cell placed inside the cylinder. According to the different shades in the photograph to be transmitted, the cell will receive more or less light, by which its resistance is raised or lowered; While an electric current from an accumulator will undergo corresponding variations of intensity. The light from the tube being regulated by the current according to the depth of the shade of the film at the sending station, a corresponding image will be produced. The transmission of a photograph requires just thirty minutes with the speed of roller at present used. Photographs have been successfully transmitted in this way and by means of the latest apparatus 5,000 words in ordinary handwriting may be transmitted per hour.—Eng. Review.

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

FUEL ECONOMY IN STEAM-POWER PLANT.

THERE are numerous economies possible in every power plant, and an endeavor will be made to point these out in the hope of stimulating the search after possible and practicable economy to suggest thoughts on which all steam engineers may work—thoughts, many of them, suggested to the authors by engineers who have directed their own energies in certain directions more than in others. Economy, commercially considered, is not identical with economy of first cost, nor yet with economy in fuel or wages. Nor can commercial economy be defined even as that compromise which makes the best return on the outlay, for there are other considerations which are sometimes paramount.



Weir Water Tube Boiler with Refractory Furnace and Combustion Chamber.

Steam-power economy is to be secured by attention to fuel and its combustion, feed-water and its treatment, and heating furnace design and arrangement, steam treatment and its use in suitable engines.

The subject divides itself into several heads, as follows:

1—Feed-water.
2—Fuel.
3—Boilers and Furnaces.
4—Steam.
5—Waste Gases.
6—Draught.

In such a paper statistics would only lead to controversies that might obscure the intention of the paper, which is rather to emphasize principles than to indicate beaten paths.

Feed-Water.

Only very few natural waters are fit for use in steam boilers without some preliminary treatment; chemical examination can alone reveal whether this treatment is required, and what must be its character.

The examination of a water intended for steam-raising purposes should cover its acidity or alkalinity, presence of oily or fatty matter, total solids, temporary and permanent hardness. The examination of the water supply should be repeated at monthly intervals, since changes occur in the composition of all natural waters according to the period of the year and the rainfall.

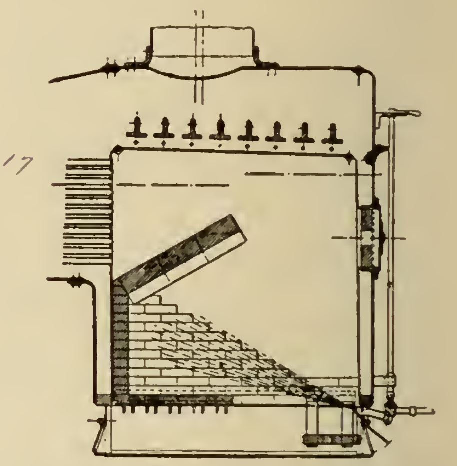
The chemist at these works spends half an hour each morning in this sampling place (which is kept locked) and tests in this time, selected samples of the previous twenty-four hours for alkalinity and hardness. Some check of this kind is imperative, since even the most reliable types of automatic softening apparatus are apt at times to get out of order, and variations in the composition of the water supply, as already noted, occur during the Spring and Autumn months of the year.

All waters containing more than 15 English degrees of total hardness (i.e., an equivalent of 15 grains of calcium carbonate per gallon) should be subjected to treatment with chemicals before use in the boilers. External treatment of the water in an apparatus which permits removal of the deposit before the water enters the boiler is an essential condition of scientific steam boiler management. A thin coating of scale upon the boiler plates is advantageous, since it protects the iron from pitting and corosion.

The advantage of feeding the boilers with water approaching as nearly as possible to the boiling temperature, is now fully recognized.

The importance of the fact that fuel represents 50 per cent. of the total works cost in the generation of electricity, and that from 10 to 20 per cent. of this outlay can be saved, is often ignored by engineers, when contemplating the low price at which they have placed their fuel contracts. It is held that because fuel is cheap, therefore it may be wasted with impunity; and much of the inefficiency to be found in the boiler houses of electrical works is to be traced to this fallacy. The supplies of fuel, whether cheap or dear, ought, therefore, to be subjected to regular sampling and testing. The sampling of fuel requirec care, if the sample is to be representative of the bulk supplies, and much of the distrust in engineers' minds relative to the value of laboratory examination of fuels, has been due to lack of expert control of the sampling operation. The testing of fuel for technical purposes should cover moisture, ash, coke, volatile matter and calorific value;

The authors assert that with suitable furnace construction and scientific control, bituminous fuels can be burnt without causing smoke troubles and with high efficiency under every type of boiler, and the great savings in fuel costs could be effected in this direction.



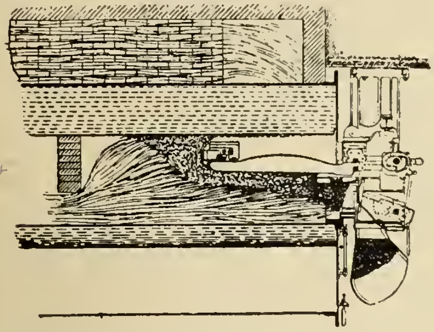
Locomotive Boiler, Brick-lined for Liquid Fuel.

Air Supply.

The gain in economy and efficiency by raising the combustion temperature inside the furnaces by the use of heated air is great, especially if heat otherwise wasted is applied to heat the incoming air. The ideal system would be to reduce the exit flue gases to atmospheric temperature by means of economisers, air heaters and preliminary feed-water heaters; chimney draught being dispensed with and the draught produced by fans. The preliminary feed-water heaters would be placed last in such a system, and the whole of the remaining heat would be removed from the exit gases by spraying the water

through them, or by use of a tower filled with tiles or flints.

The most important causes of low initial furnace temperature are, excessive air supply to the furnaces and too sudden contact of the half-burnt gases with the water-cooled tubes or plates. Larger combination chambers and refractory furnace linings are the proper remedy for the latter evil, and gas testing is the check and remedy for the former.



Vicars Stoker with Short Grate and Gas Producer Pit.

Furnaces.

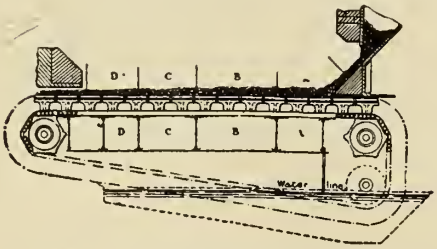
The economy possible from many appliances, lies entirely in the possibility of using a cheaper fuel. The three essentials for the proper use of bituminous coal are a furnace so arranged that the gases given off the green fuel, and the air to burn those gases, shall travel over the length of the fire together, under a draught velocity of not less than 30 ft. per second. The mixed gases must have a free, unencumbered space beyond the furnace in which to complete combustion and this combustion will be complete if the third essential of temperature be present.

In running a station, coal is one of the principal items of cost, and the ability to employ cheap coal justifies a reasonable expenditure on furnaces to enable such cheap coal to be used. Only, however, by suitable furnaces can the minimum cost be secured, and the great economy usual as between Welsh and bituminous coal is only to be had where furnace forms draught and lining are correct. Particularly in water-tube boilers, provision must be made to ensure that all heating surface is effective.

Loss of heat by radiation has long been recognized, and it will suffice here merely to indicate its reduction to a minimum by careful covering. Loss by infiltration of air has only lately been generally recognized as a serious matter.

Few men can properly stoke a furnace so long as 6 feet. The chief thing to aim at in stoking is even thickness, careful filling of hollow places and complete covering of the bars, often so neglected, at the front corners near the door. More steam can usually be made on the spreading than on the coking system, but in the spreading system either one side only should be fired at once or one-half of the length, so that the excess of air through half the grate may mix hot with the gases from the other half. Coke or anthracite, producing little or no gas, burns at or near the grate and produces a clear, bright fire. Bituminous coal cannot be thus burned. It must have time and space and temperature, and the least time and space are demanded when the temperature is highest. Mechanical stoking cannot abolish these facts, nor can it possibly be a panacea for the smoke evil.

Practical considerations render it necessary to reduce the extent of the furnace and to add an excess of air so as to ensure oxygen coming into contact with all the combustible elements of the fuel within the zone of sufficient temperature. It should be possible to do this with 25 to 33 per cent. of air in excess, and certainly with less than 50 per cent. excess. The flame of bituminous coal will be longer as the heat is kept low, so that a suitable furnace has a cumulative effect. By conserving



Chain Grate Stoker with, Air-Regulating Chambers Below.

temperature, flame is shortened, and by shortening flame, the necessity for long protected furnace surfaces is reduced.

Read at Institution of Electrical Engineers.

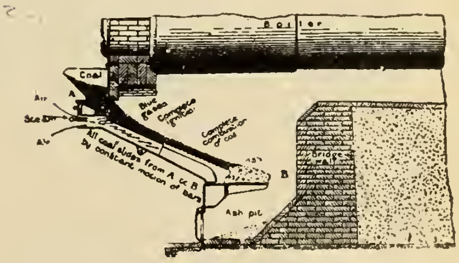
(To be continued.)

GAS FOR POWER.

THE importance of the gas industry in affording an economical means of utilizing coal can not be urged too insistently in the present extravagant age. The rate at which our stock of coal is now being diminished is 220 million tons per annum, and it is increasing. Many and differing computations have been made regarding the life of the coal fields; but no doubt at all exists that a time will eventually come, when these will be exhausted. That the welfare of the nation is closely bound up with the future of the coal fields must be evident to all; for from this mineral is derived the energy, whether it be applied by steam, gas or electricity, which drives mills, propels ships, locomotives, and tram cars, lights and heats cities, and does the thousand and one things which make life as we know it, possible. Other sources of power in nature exist, such as water falls, winds, etc.; but none other is of so much practical importance, at least, in this country, although in other lands, notably the United States of America, and Switzerland, are more favorably situated with regard to water power.

Energy is obtained from coal chiefly by means of the steam engine, the gas engine with coal gas or the gas engine with producer gas. The steam engine considered as a heat engine, is most uneconomical. Probably the average thermal efficiency of all steam driven plants in operation will not exceed four per cent. Of course, this figure is greatly exceeded in well-equipped central stations, such as those for the supply of electricity. Such stations will probably convert about eight per cent. of the heat of the coal into electric energy at the switch board, and that is all. There are no residuals of any kind; the remainder is lost; part having gone down the exhaust pipe, and part up the chimney, to pollute the atmosphere. In the case of an electricity supply company, probably not more than about seven per cent. of the energy of the coal will be delivered as current to the consumer.

How different is the result where energy is obtained from coal by either of the other methods. In the manufacture of coal gas, about twenty per cent. of the heat of the coal may be obtained as gas, about forty-seven per cent. as coke, and in addition, the crude residual products obtained have a value according to market fluctuations. Indeed, carbonization in closed chambers, such as gas retorts or coke ovens, with recovery of bye products, is a most economical process. The gas may be distributed in mains with very small loss;



Inclined Grate, with Shaking and Gravity Effects

and if it be used for power purposes in a gas engine, twenty-five per cent. of its heat may be converted into useful work.

(Read at Scottish Junior Gas Association, Glasgow).

SOME REFINEMENTS OF MECHANICAL SCIENCE.

This paper deals with some refinements turned to practical use in connection with mechanical developments from earliest times. After the sun dial came the hour glass for measuring time and then the water clock, which is supposed to have been invented by the Greeks, and was a much better time-keeper that either the sun dial or the hour glass. These clocks are used to-day very extensively in China. In Canton a water clock has been running for 800 years and is still the standard clock of that city. Clocks of the present type, although used as far back as the twelfth century, were but fair time-keepers until several centuries later. Galileo's beautiful discovery of the value of the pendulum for keeping time was of great value. Later an English clock-maker invented the mercurial pendulum by which the variation in its length caused by the difference in temperature was fully compensated and some years later another English clock-maker invented a compensating pendulum.

Every part of the clock down to the minutest detail has been the subject of study and improvement, and they are made and adjusted with such precision and delicacy that in testing them the question is within how small a fraction of a second will they run. A clock in the observatory at Berlin has run for several months, the rate of error of which was only fifteen one-thousandths of a second per day.

The division of the circle and the measurement of angles has ever been among the unsolved problems of the astronomer. Long before the telescope was invented, instruments of various kinds having graduated circles were used. The longer the radius the more accurate the graduation, was the principle upon which the early instruments were made.

The micrometer is an important instrument and to make the screw of such so true that the errors in the threads cannot be detected by its own magnifying glass is an extremely difficult task. Step by step, from the methods of the ancients down to the present-day, improvements in the instruments and methods for the measurements of angles have been going on until astronomers can measure double stars with a separation of one second apart and within less than one second they can define their positions in the heavens. The Rowland Engine is a wonderful machine and is used for ruling diffraction gratings. The production of the latter allows the physicist to study the spectrum. The interferometer is another instrument of the finest workmanship, which is being used in determining the lengths of standards in wave lengths of light.

In spite of all that has been done and in spite of the fact that marvellous machines have been built there are yet many imperfections in these lines requiring further advances in mechanical science to be worked out for the enlightenment and welfare of mankind.—Read at American Society of Mechanical Engineers by A. Swasey.

NOMINAL HORSE POWER.

What is meant by the term Nominal Horse Power, and has it any relation to the Indicated Horse Power of an engine? This is the question that suggests itself to every engineer, especially when he consults a catalogue with a view to purchasing an engine. The term has by no means fallen into disuse, as a study of recent catalogues of some makers of small engines will show, and its use is likely to mislead the uninitiated, as the actual horse power of an engine is usually many times its stated nominal horse power. The formula which is generally used in estimating the N.H.P. of an engine is

$$\text{N.H.P.} = \frac{D^2 \times \sqrt[3]{L}}{k}$$

where D = diameter of cylinder in inches;
L = stroke in feet;
k = a constant which varies with different makers.

Now the I.H.P. depends upon pm, the mean effective pressure in the cylinder, and the number of revolutions per minute in addition to the quantities given above, yet it is usually stated that the I.H.P. of an engine will be a certain number of times its N.H.P. The following investigation was made by the writer to find out whether this was a correct statement and, if so, what the multiplier should be.

Let it be assumed that, for any engine

$$\text{I.H.P.} = \text{N.H.P.} \times n,$$

then

$$\frac{pm \times 2L \cdot 7854 D^2 \times N}{33000} = n \times \frac{D^2 \times \sqrt[3]{L}}{k}$$

$$\therefore pm = \frac{n \times D^2 \times \sqrt[3]{L} \times 33000}{k \times 1{\cdot}5708 \times L \times D^2 \times N}$$

$$= \frac{n}{k} \times \frac{21000}{\sqrt[3]{L^2 \times N}}$$

Now, the boiler pressure and point of cut-off will be the same for all engines of the same class, and hence p m will be constant. Since n and k are constants, hence, if the above is true, then

$\sqrt[3]{L^2} \times N$ = a constant for all engines of the same class. In order to find out whether this was the case, the writer referred to the catalogue of a well-known firm and from the data given deduced the values of k and $\sqrt[3]{L^2 \times N}$.

It will be seen from these tables that the average value taken for k is as follows:

10 for Simple Non-Condensing Engines;
18 for Simple Condensing Engines;
16 for Compound Engines, both Condensing and Non-Condensing.

Thus, in the case of Compound Engines, the N. H. P. is the same whether condensing or non-condensing; while in the case of Simple Engines, the N. H. P. is less when condensing than when non-condensing. On examining further into the matter, it is found that the non-condensing engines are designed to work with a boiler pressure of 100 lbs., while the condensing engines work with a boiler pressure of 150 lbs. This sufficiently shows the absurdity of using a formula which takes no account of the boiler pressure. A glance at the column showing the values of $\sqrt[3]{L^2 \times N}$ shows that this is fairly constant for the same class of engine, being about 140 for simple engines and 160 for compound engines (in the case of a compound engine, for D^2 we substitute the sum of the squares of the diameters of the cylinders), so that the preceding assumption is justified and the formula has a rational basis in this respect. The trouble is that the so-called constant k varies from 15 to 40 or more according to the maker of the engine, and thus the 20 N. H. P. of one maker may be the 8 N. H. P. of another maker, so that comparison is impossible. If the use of the term is retained, surely some agreement should be arrived at with regard to the value chosen for k, as in this case the term might be useful in conveying some idea of the size of the engine without regard to its speed or steam pressure.

Taking the previous formula

$$pm = \frac{n}{k} \times \frac{21000}{\sqrt[3]{L^2 \times N}}$$

we get

$$n = p\,m \times \frac{k \sqrt[3]{L^2} \times N}{21000}$$

Thus, in the previous case, taking k = 18 and $\sqrt[3]{L^2 \times N}$ = 150, we get

$$n = p\,m \times \frac{18 \times 150}{21000}$$

$$= \frac{p\,m}{8} \text{ approx.}$$

Thus, if the mean effective pressure for this particular class of engine is 56 lbs. per sq. in., then n = 7, and

I.H.P. = N.H.P. × 7.

Usually n varies from 4 to 8, so that the actual H.P. of an engine is always greatly understated when its Nominal Horse Power is given.—Eng. Review.

Construction and Improvement

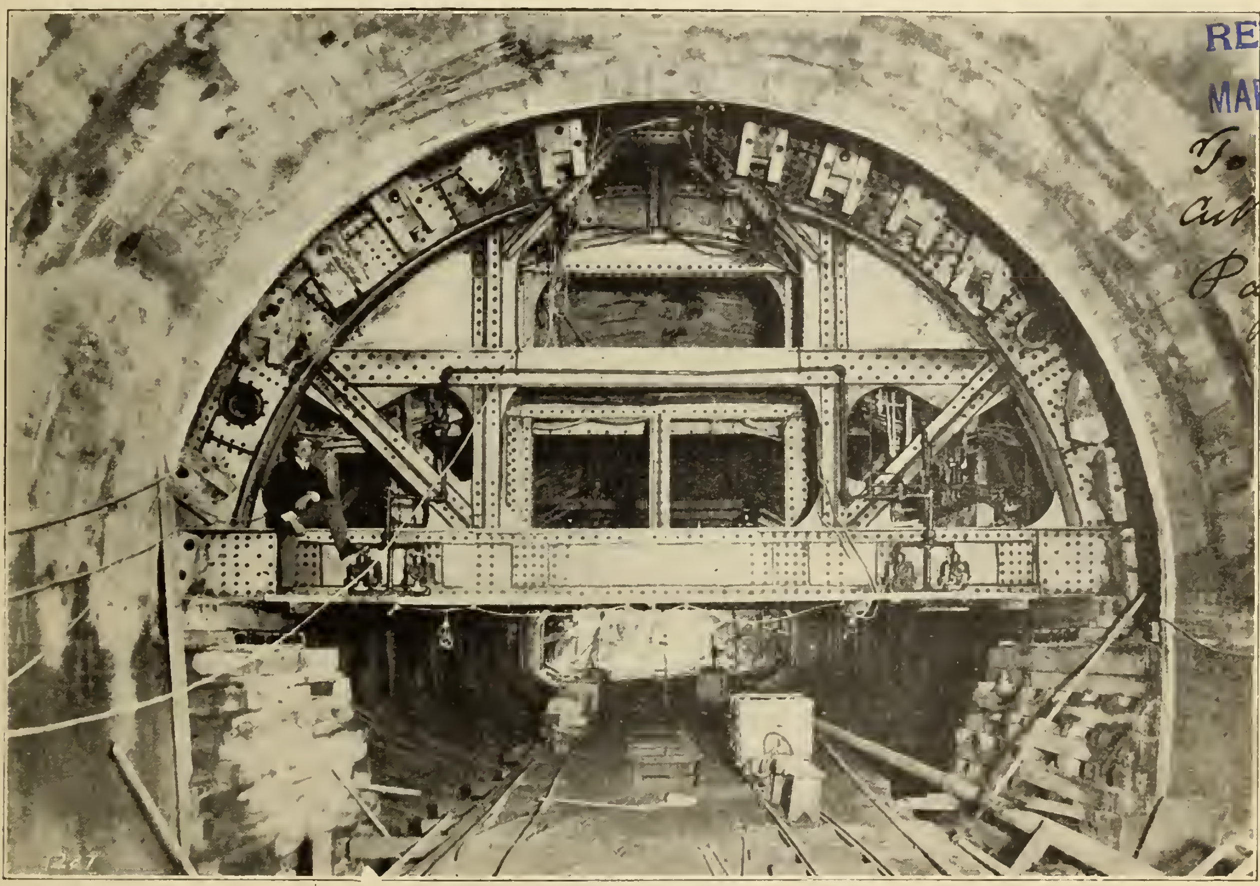
General Construction — *Contractors' Supplies*

CONSTRUCTION OF EAST BOSTON TUNNEL.

THE completion of the tunnel for the Boston Subway has marked the closing of a work in progress for the last five years, as well as an engineering achievement of great magnitude. The total length of the tunnel is approximately 7,500 feet, of which fully two-thirds was built by the shield method, the remainder in open cut excavation. The portion of the bore actually under the water of the harbor is about 2,700 feet long, the balance of the tunnelled portion passing through made ground, filled in as the growth of the city demanded. A greater depth than at present essential was demanded by the fact that allowance had to be made for possible dredging of the harbor to make a forty-foot channel. The greatest depth attained by the tunnel invert is about 80 feet below mean low water. The least thickness of earth between tunnel and water is 18 feet. The cross section of the completed structure varies at different points, but in general is the well-known horseshoe type. The bore is lined throughout with concrete, reinforced where necessary by steel rods bedded in. Ventilation is provided by powerful fan plants, forcing fresh air from either end, and electric lights illuminate the interior.

In construction the line was divided into six sections, lettered from A to F. Of these sections D and C were driven by straight tunnel methods, the other sections were built in open cut, as in common practice. Sections B and C aggregate 5,150 feet in length, and so form the major part. Section B, 1,109 feet long was started at a shaft in Lewis street and was driven by the pneumatic shield method, almost the entire distance being made under air pressure. The roof shield, a heavy structure of steel work, was forced forward by powerful hydraulic jacks, being supported on rollers resting on plates on the walls. The volume of air at an average pressure of 22 lbs. delivered to the heading, averaged about 20 cubic feet per minute for each workman. The compressing plant for these sections included seven Ingersoll-Sergeant air compressors. This air was also used in driving motors, running concrete mixers, winding engines, and other devices; while a portion was discharged direct into the advance headings for ventilation.

The total cost of the tunnel complete has exceeded $3,000,000. The work was completed in the contemplated time and the methods of construction were found in every way satisfactory. The opening of this tunnel to traffic has reduced the time of transportation between Boston and East Boston by over ten minutes.



View of Boston Tunnel under Construction.

STANDARD SPECIFICATIONS FOR PORTLAND CEMENT.

BELOW will be found standard specifications for Portland cement as issued by the council of the Canadian Society of Civil Engineers, followed by mention of some of the tests required:

The whole of the cement is to be well-burned, pure Portland cement, of the best quality, free from free-lime, slag, dust, or other foreign material.

Fineness.—The cement shall be ground so fine that the residue on a sieve of 10,000 meshes to the square inch shall not exceed ten per cent. of the whole by weight, and the whole of the cement shall pass a sieve of 2,500 meshes to the square inch.

Specific Gravity.—The specific gravity of the cement shall be at least 3.09 and shall not exceed 3.25 for fresh cement; the term "fresh" being understood to apply to such cements as are not more than two months old.

Tests.

The cement shall be subjected to the following tests:

Tensile Test. (Neat Cement.) — Briquettes made of neat cement, mixed with about twenty per cent. of water, by weight, after remaining one day in air, in a moist atmosphere, shall be immersed in water, and shall be capable of sustaining a tensile stress of 250 lbs. per square inch after submersion for two days; 400 lbs. per square inch after submersion for six days; 500 lbs. per square inch after submersion for twenty-seven days. The tensile test shall be considered as the average of the strength of five briquettes, and any cement showing a decrease in tensile strength on or before the twenty-eighth day shall be rejected.

(Sand and Cement.)— The sand for standard tests shall be clean quartz, crushed so that the whole shall pass through a sieve of 400 meshes to the square inch, but shall be retained on a sieve of 900 meshes per square inch. The sand and cement shall be thoroughly mixed dry, and then about ten per cent. of their weight of water shall be added, when the briquettes are to be formed in suitable moulds. After remaining in a damp chamber for twenty-four hours the briquettes shall be immersed in water, and briquettes made in the proportion of one of cement to three of sand, by weight, shall bear a tensile stress of 125 lbs. per square inch after submersion for six days, and 200 lbs. per square inch after submersion for twenty-eight days. Sand and cement briquettes shall not show a decrease in tensile strength at the end of twenty-eight days, or subsequently.

The manufacturer shall, if required, supply chemical analyses of the cement.

Packing.—The cement shall be packed either in stout air and water-tight casks, carefully lined with strong brown paper, or in strong air and water-tight bags.

The manufacturer shall give a certificate with each shipment of cement, stating (1) the date of manufacture; (2) the tests and analyses which have been obtained for the cement in question at the manufacturer's laboratory; (3) that the cement does not contain any adulteration.

All experiments shall be carried on, as nearly as possible at a uniform temperature of 65 degrees Fah., except when tests are being made for the purpose of ascertaining the comparative strength of cements required for Winter use.

Proportions.—All proportions shall be determined by weight.

Portland cement improves with age, provided it is properly stored and kept in air-tight bags or barrels. Specifications, therefore, should not prescribe only fresh cement.

Blowing test for free-lime.—Mortar pats prepared of neat cement and thoroughly worked, shall be trowelled upon ground-glass plates (carefully cleaned, preferably with acid) about 5 inches long by 2½ inches wide and ¼ inch thick, so as to exclude all air and moisture. The pats should be allowed to set under a damp cloth and then placed in vapor Fiaja bath tank for six hours. Upon removal the samples should not be curled up, should not exhibit cracks nor be distorted. The samples, if separated from the glass, should break with a sharp, crisp ring.

Time of Setting.—The time of setting shall be determined by noting the time required for a sample under test to bear a needle of 1-12 inch diameter loaded with one-fourth of a pound, and 1-24 of an inch diameter loaded with one pound, the mortar under test being of the consistency of rather stiff plaster or mortar. The percentage of water used shall be stated in the report.

Tensile and Compressive Tests.— The strength of Portland cements shall be determined by testing neat cement, and, if required, a mixture of neat cement and quartz sand. The tests shall be made in a uniform manner (both for tension and for compression) with briquettes of the same form and same cross section and with the same apparatus.

TIMBER; ITS STRENGTH AND HOW TO TEST IT.

A very large number of experimental observations on the strength and other properties of timber are to be found in the older text books and in the proceedings of various technical societies, etc., many of which are unreliable. This unreliability is due mainly to the fact that in the older experiments no attempt was made to determine the moisture present in the timber at the time the test was carried out, and in a very few cases were any data given as to the previous history of the timber. Again, most of the old experimenters used very small, picked specimens, and the results they obtained were therefore not really representative of the average quality of the particular kind of timber which was being tested. Ordinary well-seasoned timber in a dry building has a dryness of about 10 to 12 per cent.

A number of tests recently made by Prof. Hudson Beare, an article on which was read before the proceedings of the Dundee Institute of Engineers, include tensile compression, cross-bending and shearing. The author has made a number of tension tests on different kinds of wood, in order to show how difficult it is to secure uniform results in tension experiments. In both the American and in the German researches it was eventually decided to abandon tensile tests, because of the difficulty of securing uniform results, and on account of the fact that owing to the high tensile strength of timber as compared with its shear strength it was considered that it would be unlikely for timber to give way by tension in any structure. Compression tests are much more readily carried out, and when the point which it is desired to elucidate is the average quality of the sample of timber, then compression tests are undoubtedly the best. The specimens must not be too long as compared with their cross-sectional dimensions, if the pure compressive strength is to be obtained. Short timber struts very rarely give way by direct compression; they usually give way by shear stress. In the case of long timber struts, their strength is influenced by the ratio of the length to the cross-sectional dimensions, exactly as in the case of steel and iron columns. Cross-bending tests are a very favorite form of test, because practically no complicated machine is required for carrying out the test, and large specimens can be used without the loads becoming excessive if a fairly large span is adopted. Large timber beams frequently give way, not by cross-breaking, but by shearing along near the neutral plane, and the great weakness of timber to resist such shear stress is a matter of extreme importance, and would be carefully considered when designing timber structures. All recent experiments on the mechanical properties of timber, show that the strength of timber is considerably affected by the ratio of the summer, or solid growth, to the spring, or open growth, in each annual ring, or in other words, that the density or specific gravity is a very important factor.

Modern Canadian Manufacturing Plants

ARTICLE III.—The Works of Robert Mitchell Co., Limited, Montreal

ONE of the special features of the plant of Robert Mitchell Company, Limited, Montreal Brass Works, Montreal, manufacturers of brass goods of all kinds, is that the entire establishment, with the exception of the office buildings, which are really a part of the other, are under one roof. The works were completed last Summer, and have been occupied but a few months. This company was established in 1851, and has advanced steadily until their large business warranted the building of their present premises. The officers of the company are: President, R. R. Mitchell; vice-president, E. D. Smith; secretary-treasurer, W. V. Shaw. Their plant is one that is not surpassed by any of its kind in Canada.

The new factory occupies a whole block, 180 by 400 ft., the buildings being 180 by 400 ft., fronting on Belaire Ave., St. Henry, Montreal, and touching St. Antoine street on the northwest and St. James street on the southeast, on each of which a line of the Montreal Street Railway runs. Brick, steel and concrete play an important part in the construction. The walls are of solid brick and for the main building a large part of the surface of these is glass. This, together with a saw-tooth roof, supplied with windows facing the north, makes the place unusually bright within. By facing the roof windows north, no direct sun's rays come in, and thus the workmen are saved any annoyance on that account. The roof trusses are of structural steel, are supported by metal columns throughout, the roof proper being of concrete. The floor is made up of four inches of concrete, in which was set spruce boards five inches by two inches, placed on edge, and the whole covered with one inch hard wood flooring. The buildings are heated by means of the Webster system of steam heating, from pipes running along the outer wall, and steam radiators in the offices. Owing to the fire-proof nature of the building and the precautionary methods adopted, the fire risk is one of the best. The automatic sprinkler system covers every part of the establishment. The property is surrounded by 14-inch city mains, with 8-inch mains running through it. These supply water to 1,200 automatic sprinklers, covering every department. As an extra safe guard, should anything happen the pressure on the city mains, or any break in the pipes occur, a 40,000 gallon tank has been set up at a distance of 15 feet above the highest part of the factory, thus giving an ample auxiliary water service to cover any emergency.

Comfort of the Workmen.

A commendable feature of the plant is the attention that has been devoted to the comfort and well-being of the workmen. In the first place, the roof was so arranged that no direct sunlight could enter to interfere with the work, as mentioned before. In addition to having cheerful and well-lighted shops, lavatories have been provided in the basement, installed with the latest improvements known in plumbing practice. White enamelled hand basins provided with hot and cold water have been put in, and at these nearly one hundred men may wash at one time. There is also a large lunch and reading-room, well lighted and heated, 150 by 50 feet, generously provided with tables and chairs, lockers for the workmen's clothes, and gas stoves for making tea or coffee during the noon hour. Another feature in this connection is the exhaust ventilating system for carrying away all dust from the emery and bucking machines, in the cleaning and polishing departments. This is no doubt a guarantee of better health on the part of those employed, and more efficient service, which attention to the comfort and well-being of the workmen could well be followed by many another industrial establishment.

Foundry and Pattern Room.

Unlike iron-producing foundries, the foundry of this establishment contains no enormous cupola, with its attendant gallery and charging apparatus, taking up a great amount of space. Its special feature is an oil-fed melting furnace, capable of fusing 500 lbs. of metal in thirty minutes. The oil is pumped into it by means of a Blake oil pump, from a large tank located in the yard. Air blast is provided from a centrifugal fan run from the motor in the cleaning and polishing department. In addition to this furnace, there are ten auxiliaries of smaller size, set in the floor, the tops of which are level with the surface of the floor. Coke is used

Lamp Shop — Robert Mitchell Co. Works.

for heating purposes, and in these brass, phosphor bronze and copper are melted. In this, as in other large foundries, traveling cranes for the facilitious handling of materials and molten metal are used to a considerable extent. In common with other labor-sav-

Value Shop—Robert Mitchell Co. Works.

ing devices and arrangements, molding machines have been installed. Each of these is capable of turning out about 2,500 pieces of work a day, and they are in constant operation. This department is separated from the main workshop by a solid brick wall and metal doors.

Adjoining the foundry, but separated from it by a 12-foot solid brick wall and automatic metal door, is the pattern room. This room affords one of the best examples of a fireproof chamber that could be found. Surrounded by a 12-foot brick wall, the only openings are the windows, provided with wired glass, and the doorway, shielded by a metal door. The floor and ceiling are of concrete, and as in the case of the rest of the building, the roof truss is of structural steel. These, together with a complete sprinkling system, reduce the fire danger to a minimum. Here are stored thousands of patterns, mostly of small size, arranged in shelves against the wall and along the middle of the room. Every section of a shelf is numbered, and the patterns on it are indexed and catalogued, so that even amongst a very great number any one pattern may be found at a moment's notice.

The Main Shop.

With the exception of the foundry, all the mechanical departments of the firm are to be found in one enormous room, which at first sight presents a bewilderment of shafting and moving belts, but in reality is divided into sections, each running independently, and yet in harmony with the whole. Overhead shafting is used, but it is not run by one large unit. Each section has its own electric motor, direct current being used, thus allowing the different lengths of shafting to be run at any desired speed. The different sections, which are: cleaning and polishing department, plating department, lamp shop, valve shop, machine shop, and tool department, copper shop, blacksmith shop, meter shop, and raw goods department, run diagonally across the building, and as will be seen from the illustrations, are parallel to the roof windows, so that

Meter Shop—Robert Mitchell Co. Works.

throughout their entire length, the departments are uniformly lighted.

Nearest the foundry is the cleaning and polishing department, where the rough castings are sawn apart and then put through the rumblers. These have a stream of water running through them, so that there is absolutely no dust. From there they go to the emery wheels to be trimmed smooth, and then polished or buffed where necessary, before going to the plating backs or to the different departments to go into the make-up of the different products of the company.

In the electric plating department are seven tanks, capable of handling the largest as well as the smallest work, with equal facility. The largest tank is fifteen feet long and three feet wide, with several others nearly as large, and the plant is capable of turning out between two and three pieces a day, according to the class of work. All classes of brass work are handled, including parts for gas and electric fixtures, for plumbing supplies, passenger and street car fittings, etc., some to be nickle plated, others copper or brass plated or oxidyzed finish.

The lamp department contains long benches, where the gas and electric fixtures are put together, as well as general fittings assembled. A number of lathes are to be found here, where all classes of spun metal are turned out.

All the tools used in the entire factory are made in the machine shop and tool room, thus enabling the exact requirements of each department to be satisfactorily attended to. The complement of machine tools consists of about twenty machines, including light and heavy lathes, turret lathes, milling machines, shapers, planes and drills, operated by experienced workmen.

The valve shop, shown in the illustration, is equipped for the manufacture of all classes of valves, stop cocks, water cocks, etc., used in plumbing, heating, and ventilating systems.

At the present time, in the meter shop, there are about 2,000 gas meters in different stages of completion. This

department has a capacity of 350 meters a week, and from it has been supplied over 15,000 meters to one gas company alone in Canada.

The copper shop is for the manufacture of different classes of copper goods, such as copper tanks, ordinary kettles and tank kettles.

Besides copper and brass goods, this firm manufactures ornamental iron work. From the forges and anvils of the blacksmiths' shop come fancy forging iron lamps, iron grills for bank and office counters, door and window grills, as well as other lines of ornamental iron work.

The last department to be mentioned is that devoted to raw goods, where about seventy-five tons of brass castings are kept on hand ready to be made up in the different shapes.

Offices.

The office building is connected to the other, but uses two storeys above it. In the basement is situated the shippers' offices. The second floor contains the main business offices and private offices of the members of the firm. These are handsome in appearance, with hardwood finish. On the upper floor are the drafting offices and designing departments, where new designs for gas and electric fixtures, ornamental iron work, etc., are worked out.

While there are many larger manufacturing plants and industrial companies in Canada, there are many points in connection with the factory described that might serve as an example for others.

FLEXURE OF REINFORCED CONCRETE BEAMS.

Many and diverse opinions exist regarding the action of combined steel and concrete and the method of calculating the strength of same. A series of tests regarding the strength of reinforced concrete beams have been made by Professor Talbot and presented in a paper before the Western Society of Engineers. Twenty-two reinforced concrete beams 15 feet 1 inches long by 12 inches wide and 13½ inches in depth were tested. Chicago "A A" Portland cement bought in the open market was used. The concrete was by loose volume one cement, three sand and six stone.

General Phenomena of the Tests.

Through the first stage as the load is applies the action of the beam and the changes in formations of upper and lower fibres, are similar to those in plain concrete beams, modified of course by the metal reinforcement; and the resistance of the tensile stresses of the concrete is plainly apparent. When a load of about 4,000 lbs. for 1-10 per cent. reinforcement and of about 6,000 lbs. for 1.5 per cent. reinforcement is reached (equivalent to about 250 lbs. per sq. in. when the weight is considered), the second stage begins. The steel elongates more rapidly with the application of the loading, there is a similar increase in the compression of the concrete, the neutral axis rises, and there is a marked change in the character of the load-deformation diagram. While no cracks are visible to the naked eye at this second stage, it is evident that much of the tensional value of the concrete has been lost. During the third stage the increments of the deformation of the steel are closely proportional to the increments of the load. During this stage vertical cracks appear, generally numerous and distributed along the middle third line of the length of beam, and growing in width. This continues until a point at or near the maximum load is reached, except with those beams having an excess of reinforcement. The stage of failure begins at or near the maximum load. The beam deflects more and more, the load required, to balance the scale beam gradually becoming less. The steel stretches rapidly, the neutral axis changes its position, and there is a more rapid compression of the upper fibre of the concrete, until finally it crushes out at the top of the beam at a load below the maximum, after the steel has stretched considerably beyond its yield point. The exception occurs with beams having more than 1 per cent. of metal of 55,000 lbs. per sq. in. elastic limit, or more than 1.5 per cent. of 35,000 lbs. per sq. in. elastic limit. In such beams the concrete at the top fails by crushing before the elastic limit of the steel is reached. In all the others the full compressive strength of the concrete was not developed at the maximum load.

Maximum Load at Yield Point of Metal Compressive Stresses.

The ordinary formulae give a larger compressive stress at the remotest fibre than actually exists there. The relation between stress and deformation near the crushing strength of concrete is probably different from that assumed in such formulae.

Shear and Adhesion.

It had been anticipated that some of the beams might fail by diagonal tensile stresses induced by shear. As a means of counteracting this, a portion of the bars in beams with 1 sq. in. metal or more were bent upward outside the one-third points of the beam and inclined diagonally to points about 1 ins. below the top at the ends. In no case was there a crack or failure of the kind usually attributed to shear.

Plain Concrete.

In plain concrete beams it was observed that the neutral axis is very close to the middle of the depth of the beam. This would indicate that for the beams the co-efficient of elasticity of concrete for tension and that for compression are approximately equal.

A UNIQUE MENU CARD.

An interesting dinner was given at Sydney by the representatives of the steam and electrical companies assembled

THE CANADIAN STEAM & ELECTRIC MAGNETS

TO THEIR HONORED GUESTS

DOMINION IRON & STEEL KINGS

SYDNEY

February 4th, 1905.

DINNER

1000 VOLT COCKTAIL

SOUP

Engine Room Consomme — Electric Fish Chowder
Fuse Wire — Steel Billets

FISH

Baked Armature Coils, Shellac Sauce

ENTREES

Superheated Steam, Vacuum Sauce
Wire Rods (Hot)

ROASTS

Roasted Customer — Roast Salesman
Triple Expansion Gravy — Turned Down Dressing

VEGETABLES

Steamed Potatoes — Automatic Stoker — Ammonia
Tar — Coke — Slag

SWEETS

Revolving Field 3 Phase
60 Cycles — Medium Speed — Blowout Magnet
Automatic Cutoff — Dead Short Circuit — Shut Down

Steam and juice not on bill of fare charged extra.

Temperature of consumers must not exceed 70 Centigrade.

Owing to unsettled market all quotations on Domsteel products are withdrawn while the house is in session.

there on the occasion of the awarding of a large contract for engines and generators. The accompanying menu card was a feature.

THUS CAME THE RAILWAY GAUGE

It is an interesting story how George Stephenson came to adopt the 4 ft. 8½ in. gauge for his railways. A young man who was in the employ of George Stephenson, and was one of the latter's principal men when he made his Newcastle and Carlisle Railway about 1832, asked the great engineer how he came to fix the gauge. George Stephenson told him that he got his idea from inspecting some portion of the Roman Wall through which the chariots used to be driven. Deep ruts were worn, and on measuring these, he found their distance apart to be, as near as possible, 4 ft. 8½ in. Stephenson thought that if a world power like the Romans had made such use of a measure for its chariots, he could not be wrong in adopting those measurements as a rule for his railway; and railways, he felt confident, would extend all over the world.

Engineering Societies : Business Meetings.

MONTREAL ROLLING MILLS.

AT the 38th annual general meeting of the shareholders of the Montreal Rolling Mills Company, held during the latter part of February, the old board of directors was re-elected, viz.: E. S. Clouston, president; Wm. McMaster, vice-president; Sir George A. Drummond, Hon. Robert Mackay, Sir Montagu Allan, Bartlett McLennan and James Ross, with Jas. L. Waldie as secretary.

MONTREAL STEEL CO.'S MEETING.

The annual meeting of the Montreal Steel Works Limited, was held in the company's offices with Mr. K. W. Blackwell, the president, in the chair. The annual report was read, and on motion was carried unanimously. The old board of directors was re-elected for the coming year. Notwithstanding the dull times experienced by the iron and steel industries during the first six months of 1904, they showed net earnings available for dividend on the common stock of 15 per cent. or 30 per cent. on the price at which this stock was issued to the original shareholder. They are beginning to realize the benefits of a large and up-to-date plant.

ENGINEERS' CLUB OF TORONTO.

The officers of the engineers' club of Toronto, for the year of 1905 are: President, R. F. Tate; first vice-president, F. L. Somerville; second vice-president, T. B. Smith; directors, A. B. Barry, G. R. Mickle, W. H. Patton; auditors, T. B. Speight, J. S. Fielding; treasurer, W. J. Bowers; secretary, Willis Chipman.

Weekly luncheons are held in the rooms of the society. Papers are read from time to time, not only by members, but by members from outside, followed by discussions, which are of the greatest value to the engineering profession in Toronto.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

This society is divided into four sections—electrical, mechanical, mining and general. A meeting of each section is held at the society rooms, 877 Dorchester street, once a month, where papers relating to the different branches are read and discussed. The officers for this year are: President, Ernest Marceau, Montreal; vice-presidents, C. H. Keefer, Ottawa; D. Macpherson, Montreal, and G. A. Mountain, Ottawa; councillors, John Kennedy, W. F. Tye, G. A. Keefer, C. H. Rust, A. E. Doucet, Phelps Johnson, R. W. Leonard, P. W. St. George, W. B. Mackenzie, Prof. R. B. Owens, M. J. Butler, Prof. R. J. Durley, G. J. Desbarats, Dr. J. B. Porter, and H. C. Burchell; nominating committee, for Ontario, G. A. Mountain, C. H. Rust and Prof. J. Galbraith; for Quebec, F. Shearwood and W. McLea Walbank; for North-West Territories, G. H. Webster; for Maritime Provinces, F. W. W. Doane; outside of Canada and Newfoundland, H. Irwin.

ENGINEERING SOCIETY SCHOOL OF PRACTICAL SCIENCE.

The Engineering Society, established by the students of the School of Practical Science of Toronto, meets every two weeks, at which papers are read and discussed, dealing with technical subjects. The officers for the ensuing year are: President, E. A. James; vice president, Wm. Treadgold; recording secretary, G. W. Graham; treasurer, A. K. Munro; corresponding secretary, F. R. Ceasar. At a recent meeting Cecil B. Smith read a paper on Niagara Development.

MINING INSTITUTE MEETING.

The annual gathering of the Canadian Mining Institute was held at the Windsor Hotel, Montreal, recently, and the following officers elected for the coming year: President, George R. Smith, M.L.A., Bell Asbestos Co., Thetford Mines, Quebec; vice-president, Thomas Cantley, Nova Scotia Steel and Coal Co., New Glasgow, N.S.; Dr. W. L. Goodwin, director School of Mining, Kingston, Ontario; Dr. Frank D. Adams, McGill University, Montreal, Quebec; secretary, H. Mortimer Lamb, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Mr. E. D. Ingall, M.E., of the Geological Survey, Ottawa, submitted a summary of the mineral production of Canada for the year 1903, which read in part: The main feature presented by the mineral industry of Canada as a whole consists in the decrease in the grand total of production of a little over one per cent. in comparison with the figures for 1902. A comparison of the items for the two years shows the reason for this falling off. The shrinkage in the production of the Yukon placer gold fields accounts for $2,250,000 of the total diminishment of over $2,500,000 in the gold output of the country. This is augmented by over $1,000,000 decrease in the values of the output credited to others of the metallic class, viz., pig iron, silver, lead and nickel. To offset this, the copper, iron ore and zinc industries exhibit increases, aggregating nearly $1,500,000, leaving a minus amount of a little over $2,000,000 against the metallic class as a whole, equivalent to nearly six per cent.

MARINE ENGINEERS.

The National Association of Marine Engineers will hold its next convention at Levis, Quebec. The new officers include E. S. Henning, Toronto, grand president; Neil J. Morrison, St. John, N.B., grand secretary (re-elected); Charles Robertson, Owen Sound, conductor; Therian, Levis, doorkeeper; Gillies, Kingston, and Cronk, Windsor, auditors. At the banquet held on Thursday evening Mr. McCarthy, Mr. J. S. Duff, M.P.P., and Captain Donnelly, Kingston, were guests.

NEW SALES OFFICE.

Mr. William M. Moran has been appointed sales agent of the Allis-Chalmers-Bullock, Limited, Montreal, for the Maritime Provinces, with his office at Halifax, N. S. He is a graduate of Washington University, mechanical engineering, and during the past fifteen years has been engaged in electrical and railroad work. He has been connected with the Brush Electric Company and the Edison Electric Company, and latterly was chief engineer for Townsend and Reed, of Chicago, one of the largest railroad contracting firms in the United States.

A PRETTY CALENDAR.

The Canadian Westinghouse Company, whose head office and works are in Hamilton, are sending out a very pretty calendar from February 1, 1905, to February 1, 1906, the handsome feature being the figure of a young lady holding a bunch of rose buds. Mention Machinery when writing.

CANADIAN

MACHINERY

AND MANUFACTURING NEWS

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THE PASSING OF NIAGARA.

MUCH has been heard of the "passing of the horse," and many unfulfilled prophecies have been uttered in that connection with little prospect of their being materialized. As far as present indications go, the "passing of Niagara" is more of a reality. In fact, it is certain that before many years have come and gone the grand and sublime spectacle as it appears to-day will be a thing of the past. The danger of the Canadian Fall being obliterated is not great, but the destruction of the American Fall seems imminent. Being nine feet higher, it is certain that while there is yet, at least, nine feet of water passing over the Canadian cataract, the visitor to the American side may stand dryshod on the precipice at the brink of the present fall and view the scene, in the same way as he may to-day, from Terrapin Rock.

This fact has already been borne home to some of the most public-spirited citizens of the United States, and has caused no small flurry of excitement. Their agitation is not without reason. When a strong wind has been known to lower the level at the mouth of the river sufficiently to cause a cessation of the flow on that side, it must be recognized how slight are its chances of existence when a large percentage of the river flow is diverted to other channels.

The development of the water-power at the Falls itself is not the only influence at work, leading towards its destruction. There are many other channels by which water from the Great Lakes may be diverted, any or all of which will work towards the same end, namely, that of lessening the present flow of the Niagara River. Now, the River Niagara carries practically all the discharge from the upper lakes—Superior, Michigan, Huron and Lake Erie. This will not always be so. For instance, any water power developed along the Welland Canal will affect the flow, and although there is only one company of any importance utilizing the water of Lake Erie in this way, there will in all probability be others in the near future. Again, there is the question of a canal from Georgian Bay to Lake Ontario, whereby a large quantity of water would be brought directly from Lake Huron without going by the way of the Niagara Peninsula. There is also the possibility of diverting some of the water from Lake Michigan into the Illinios River at Joliet, only 25 miles away, and developing a great water-power, the Chicago drainage canal being an example of what is possible at this point. Private companies will continue to spring up with a view to acquiring further rights at Niagara Falls itself; and it is already proposed to develop more power on the Ontario side than is at present in process of development. It can hardly be expected that such companies will not cease to avail themselves of the advantage of the power that can be so cheaply developed, and get a share of the profits to be realized.

A million and a half horse-power is capable of being developed, and what is its value? The best manner in which to view the question is on a basis of an equivalent saving of fuel consumption. For steam-developed power it takes on an average of three pounds of coal per horse-power hour, or 12.14 tons per year. Assuming that 50 per cent. load factor be the average for this power for 24 hours in the day, we have three-quarters of a million horse-power years, or an equivalent to 9,105,000 tons of coal consumed per annum. This, with coal at $3 per ton, which is about the average in Ontario, means a yearly revenue of $27,315,000, which, on a 5 per cent. basis, represents a capital stock of $546,300,000. Small wonder, then, that companies are not slow to endeavour to acquire concessions and rights for long periods of time.

All this development is going to give an impetus to manufacture and industrial progress, and the question that must be decided, and decided soon, is whether it is better to continue developing the water-power to promote industry or to take steps to preserve for future generations this, one of the grandest of natural phenomena.

THE VALUE OF KNOWING COSTS.

COST-KEEPING as a means towards more economic production is coming to be recognised as an important branch in industrial concerns. As competition becomes keener and prices of manufactured products tend to decrease, the fact that every detail in the cost must be carefully guarded becomes the more apparent. Cost systems have been devised that enable the cost of machines to be reached at a glance at any stage of their construction. The value of this is seen when it is considered that economies may be developed along certain lines where formerly no

leak was suspected. The average business man has little knowledge of the cost of materials of construction, and the average mechanic or technical graduate none at all.

This is an important matter, and it is surprising that it has not been considered more fully in the past. Oftentimes one of the great differences between a man with a few hundred dollars' salary and one with several thousand is due to the fact that the latter has taught himself the great importance of placing a proper estimate on commodities in their market relation both to the producer and to the consumer.

That the question has not been given the attention it calls for is shown by the fact that the Worcester Polytecnnic Institute is including in its engineering curriculum a course in cost-keeping, which, although lately adopted, has already proved its value. A system like this might well be adopted in the Canadian Technical College, as there is little doubt that the business training thus acquired will mean everything to the budding engineer. The man who acquaints himself thoroughly with the costs of everything along his own line will not remain long in an inferior position.

GAINING THE SYMPATHY OF THE WORKMEN.

A GOOD plan has recently been adopted by the Hamilton Bridge Works which, if more generally adopted, would be the means of bringing about a stronger spirit of union between employers and employes, and have the effect of avoiding many of the strikes that are at present only too common.

A notice was recently posted by the president of the company as follows: "A dining and reading-room have been provided by the company for the use of employes during noon hour. The room will be opened at 6.45 a.m., so as to enable those desiring to use it to leave their dinner there. It will then be locked again and opened at noon. As this is for the general comfort of the employes we hope that everyone will take an interest in seeing that it is kept neat and clean.

"The company have subscribed a sufficient sum to the Hamilton Art School to enable them to nominate four pupils, who will receive free instruction in mechanical and structural drawing for one year. Those desirous of taking advantage of this will apply—through the superintendent—to the company's engineer.

"The company has also procured a library from the International School of Correspondence in technical work, which consists of books on structural steel, general engineering, mechanical engineering and electrical engineering. These works will be available for the use of employes who desire to improve themselves in their present vocation."

An act on the part of any company or industrial concern such as this cannot fail to be appreciated by those connected with the establishment, and we are sure that the Hamilton Bridge Works will have no cause to regret the outlay coincident with the above announcement, but will establish a bond of union between themselves and their help that will strengthen as the years go by. This spirit might well be emulated by other firms, especially those who from time to time experience trouble with their workmen, as a proper feeling of sympathy between a company and its employes is the greatest guarantee of an absence of labor difficulties.

A LITTLE LATE.

THE Toronto branch of the Canadian Manufacturers' Association has issued a letter to the members of the association in Toronto, London, Guelph, Woodstock, Brantford, Stratford and Ingersoll, calling to their attention the fact that an inquiry is on foot regarding electric power development possibilities for these cities. A commission has been appointed, and the services of a firm of prominent consulting engineers secured to carry on the investigation. The letter asks the co-operation of the members in the different places mentioned by giving data regarding their own power requirements. This is a commendable undertaking, and it is hoped that its ultimate object may be reached, that of enabling the manufacturers and power users of Ontario to obtain power at lessened cost.

It is inferred from the location of the municipalities mentioned that Niagara's power is proposed to be used. If this is so, why was the matter not brought up earlier, before the most valuable rights and privileges of Niagara had been granted to private companies. The manufacturers of Ontario have a right to the resources available, and at the lowest possible price, but as matters at present stand the prospect of their securing this is none too bright.

ENGLISH CAPITAL TO BE INVESTED.

THE assurance given by D. M. Stewart, general manager of the Sovereign Bank, in London, during the past week that British capitalists were looking to Canada for investments, but confirms what has already been felt in this country. After holding back for many years, they are beginning to feel a confidence that never before existed. This is begotten only after a rigid examination into existing circumstances. It is being recognized, slowly perhaps, but nevertheless surely, that the virgin possibilities for invested capital are unrivaled. The building of railways, the development of water-power, the operating of mines and timber limits, the establishments of manufactories and the opening up of new country offer for the conservative investor in Britain a wide range and the brightest prospects. While this movement was bound to come sooner or later, the fact that it has received an impetus recently tends to strengthen the present bond of union between this and the Motherland. Speaking of the matter, Mr. Stewart said: "Anything that will tend to strengthen that connection must be to our interest as Canadians. I have had any number of inquiries from financial houses and

private capitalists regarding Canadian investments, and there will undoubtedly be a large influx of English capital this year. I was able conscientiously to recommend Canada as a safe and remunerative field for investments, but, of course, I pointed out that in such a big country there are apt to be a few "gold bricks" lying about, and investors should take proper precaution to avoid them. On the other hand, it is the duty of Canadians to facilitate investigation, and do everything they can to put the capitalists of Great Britain in touch with only really good and meritorious propositions. That is the best way to make Canada favorably known in the financial world. In the same way we cannot be too careful about the quality of the goods we export to the British consumer. We have a reputation still to make as well as to sustain, and this can best be done by sending out goods that are exactly according to representation. It behooves all Canadians, in their own best interests, to see that the interests of the British importers and capitalists are alike properly safeguarded."

MORE TECHNICAL EDUCATION NEEDED.

FROM what is known of the advances along the line of technical education in other countries, and the benefits that have been derived by placing such advantages within easy reach of the mechanic, it must be recognised that in Canada we have been slow in grasping the situation and viewing it in the proper light. Every manufacturer will sooner or later realize the boon that accrues to his industry when his men have a deeper knowledge of their work than that gained from every-day practice. Many a job has been spoiled, not because the mechanic was not skilled, but because his knowledge of mathematics, of mechanics and of strength of materials was not such as to enable him to take a broad grasp of his work.

The little that has been done towards this end is but a start. Outside the technical departments of the universities a few schools have been established, but in looking at statistics it is shown that little more than 1 per cent. of the outlay for education in Ontario is for technical advantages. The few schools established are not within the reach of the many. Correspondence schools are doing good work, but their ultimate usefulness is restricted. There is not a manufacturer in the land but will admit that if this country is going to take a leading place in manufactured products it can only be accomplished by educating our workmen to the highest degree of usefulness. To this end, by helping their own mechanics, they are really benefiting themselves the most in taking the initiative. At the present stage of the country's development it is with the manufacturers themselves that a solution of the problem must be sought.

We find some of the largest and most progressive industrial establishments in the United States assisting their men by giving them access to technical books and technical magazines, and it is gratifying to note that a start is being made in this direction in Canada. In many towns there are few advantages or chances whereby the average workman may learn more of his particular line of work. Public libraries, as a rule, do not contain such books, although there is every reason why they should, and for the individual himself to purchase a technical library is nine times out of ten out of the question altogether.

The manufacturers' opportunity is apparent. A small library of technical books covering the fundamental principles of science, mechanical principles and movements, books on methods and materials of manufacture, as well as some inspirational books, of which there are many in print, would be a small expense item in the yearly total, but would mean much to the relations between the men and the firm, and everything to the spirit in which the day's work would be done.

CAN STRIKES BE AVOIDED?

EVEN in Canada, where labor difficulties have been mild in comparison with what other countries have experienced, there has been enough trouble between organized labor and capital to arouse comment. Two long-fought-out strikes in particular within the last year in the metal and machinery trades have ended unsatisfactorily to all concerned. Builders' strikes in Montreal and elsewhere retarded progress not a little. The master pilots helped to disorganize matters in commercial circles during the past season, and many a cargo was delayed in reaching its destination. Legislation has been backward in dealing with this important question.

The latest movement in labor circles that is likely to be of national import is an agitation amongst the marine engineers to open hostilities on the commencement of navigation. What this would mean to trade and commerce is well known, and earnest efforts should be made to retard its culmination.

While it is recognised that the proper way to avoid strikes is to have a tangible bond or union between employers and employes, it is equally well known that this is not always possible, for the same reason that even man and wife do not always live in harmony—on account of differences of opinion. Arbitration is no doubt the proper solution of the problem. Since capital and labor sometimes refuse to arbitrate, it should be compulsory under Government supervision. If a law were passed prohibiting general strikes and compelling a board of arbitration to meet to settle differences in cases where a climax has been reached, consisting of representatives from each side and from the Government, arrangements could of surety be made with less trouble, little expense and infinitely less hardship and general inconvenience than is felt as matters at present exist.

Practical Questions and Answers

QUES. What would be the pitch diameter of a spur gear wheel that is to have 50 teeth with a pitch of 2 inches?

Ans. In considering two spur gears in engagement with each other, one can imagine the teeth being made smaller and smaller in size and at the same time greater and greater in number, until they become indefinitely small and the surface becomes practically smooth. Such rolling surfaces constitute the pitch circles of the gear wheel, and the aim of toothed-gearing design is to shape the teeth so that the rolling action of the pitched surfaces may be maintained and at the same time forces of determinate magnitude transmitted without slip.

In discussing gear teeth, therefore, the pitch circles of which the rolling action is to be reproduced, are the basis upon which the teeth are constructed.

When

R = radius of pitch circle

t = distance from centre to centre of adjacent teeth = circumferential pitch.

Z = number of teeth

Then

$$\frac{R}{t} = \frac{Z}{2\pi} = 0{\cdot}15916\ Z$$

$$R = 0.15916\ Zt$$

When the gear wheels are of large size and to be cast, made from wooden patterns, it is desirable to work to definite and convenient lineal pitch distances for the wheel mentioned.

Substituting values

$R = 0{\cdot}15916 \times 50 \times 2 = 15.9$ inches

Pitch diameters $= {}_2R = 31{\cdot}8$ inches

Ques. How do you find the horse-power transmitted by a belt of a certain width, running at a given speed?

Ans. Different authorities give different formulas. The power transmitted by a belt is measured by the pull and by the lineal velocity at which the belt travels. There are limitations to the amount of pull by the ultimate strength of the belt and by the friction upon the pulleys, and the lineal velocity is dependent upon the revolving speed of the pulleys and upon their diameter. Tensions maintained in actual practice range from about 30 to 60 lbs. per inch of width. If a high tension is put upon the belt transmission when it is installed, it will gradually diminish, owing to the stretch, and unless some tightening device is employed, the belt will, before long, slacken, until the stress upon it becomes low enough to check further stretching.

If

w = width in inches

s = speed in feet per minute

N = horse power

t = tension per inch wide of belt

$N = \dfrac{t\ w\ s}{33000}$ = Horse Power capable of being transmitted.

Ques. In a motor using compressed air, what is the rule for finding the quantity of air required in cubic feet per indicated horse-power?

Ans. According to Hiscox, the flow of compressed air in pipes is found from the formula:

$$Q = c\sqrt{\frac{P\ d^5}{W\ L}}$$

where

Q = Flow in cubic feet per minute

p ± difference in pressure in pounds per sq. in. by which the flow is caused.

d = diameter of the pipe in inches

L = length in feet

w = density of the entering air in pounds per cubic foot.

c = a constant co-efficient which may be taken as 58.

Ques. What are the analogies existing between the flow of electric current in reference to voltage, resistance and amount of current?

Ans. In electricity, pressure is registered in volts called the electro-motive force, or difference of potential, and represented by the letters E.M.F. In water, the head, or difference of level in feet, is considered, or the difference of pressure for square inch in pounds. Regarding resistance, which is measured in ohms in electricity, it increases directly as the length or the conductor or wire, and varies with the nature or quality of the conductor, and is inversely a sectional area. In the flow of water, the resistance of pipes, and apertures, increases with the length of the pipe with contractions and roughness, and decreases with the increase of sectional area. Regarding the amount of electricity, which is registered in amperes, it is called the current strength, or intensity of current, or rate of flow.

Amperes equal $\dfrac{\text{volts}}{\text{ohms.}}$

With water the rate of flow is measured as cubic feet per second, gallons per minute, or volume divided by the time. In the mining regions, it is sometimes expressed as the miners' inch.

Ques. How do you measure what would be the brake horse-power of an internal combustion engine without making a brake horse-power test?

Ans. The brake horse-power may, in general, be expressed by the formula:

$$\text{B.H.P.} = \frac{D^2 \times L \times R}{C}$$

Where

D = diameter of cylinder and inches

L = stroke in inches

R = constant depending upon the fuel.

For a four-cycle engine, C may be taken as 10,000 for natural gas, and 18,000 for gasoline. The value of C may be determined from any engine in which the brake horse-power has been found, and then this value can be used for subsequent computations with the same fuel.

Ques. (1) Would you give me the reason, in your next month's Canadian Machinery, what is the cause of a flat engine valve wearing so that it has to be planed nearly every two months? (2) Is there a way to harden the surface of said valve so that it will not wear?

Ans. (1) The pressure is probably too great. Could you send in a sketch of valve? (2) The valve slide might be surface hardened, but there would be a tendency to warp.

Ques. What is the formula for finding the time required for a body to fall a certain distance?

Ans. Time equals velocity divided by g representing the acceleration due to gravity, which is approximately 30.02 or time, equals twice the space divided by the velocity. Thus, if a body fall 2,116.06 feet striking the earth with a velocity of 369 ft. per second, time will be 2 x 2, 116.6 divided by 369, equals 11.4 seconds.

Ques. What is the ultimate strength of structural steel in pounds per square inch?

Ans. Structural steel is divided into three grades, rivet steel, soft steel and medium steel. The first to fulfil standard specifications should have an ultimate strength of 48,000 to 58,000 lbs. per square inch, soft steel from 52,000 to 62,000 and medium steel from 60,000 to 70,000.

Power and Transmission

Steam. Gas. Electricity. Compressed Air. Water.

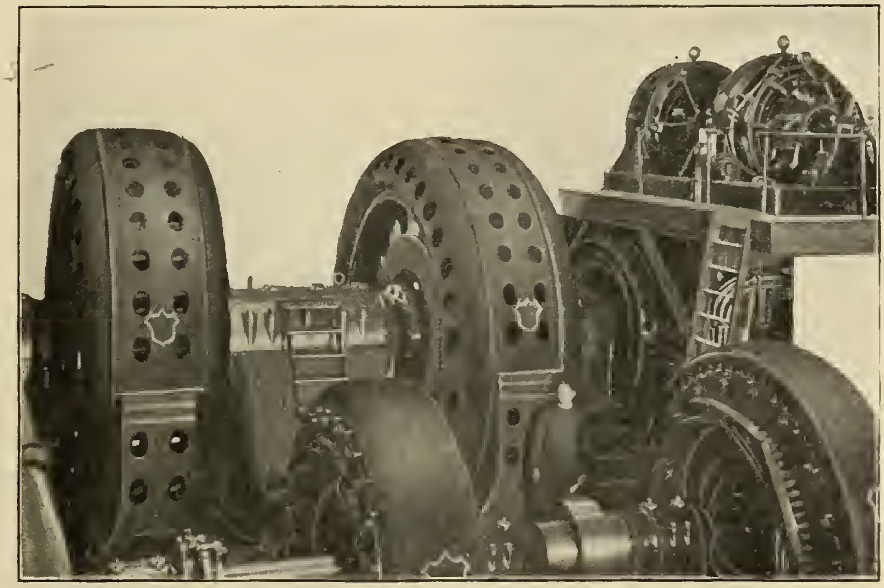
A GIANT FREQUENCY CHANGER.

THE largest frequency changer ever built has just been installed in the sub-station of the Shawinigan Water & Power Co., Maisonneuve, Montreal, and tests have proven its successful operation. The necessity of this machine was due to the fact that the current from the Shawinigan Power House, over eighty miles distant, is transmitted at thirty cycles, which must be changed to sixty to conform with that in use on the Montreal Light, Heat & Power Co.'s lines for lighting and power uses for Montreal. This machine was installed by the Allis-Chalmers-Bullock Co., Montreal, who supplied all the machinery for this sub-station.

The frequency changer itself consists of a synchronous motor directly connected with a generator and a starting motor all on the same shaft and mounted on the same base.

The starter is an induction motor, specially designed to give a heavy starting torque. As a general thing the rheostats are mounted on the switch-board, but in this case they are so large that this course was impossible, and they have been placed in a separate room and are operated by a separate motor, and controlled from switch-boards. The exciter set consists of a 200 k.w. 120 volt., direct current generator, which supplies direct current to the field of the frequency changer, directly connected to a 300 horse-power induction motor of 400 revolutions, the latter built by Allis-Chalmers-Bullock, Limited, Montreal.

A few figures will show the enormous size of this machinery. The total length of the frequency changer is 30 feet, and the motor and the generator are each 15 feet high. The total weight is 500,000 lbs., or 250 tons. The middle pedestal alone weighs 34,000 lbs., or 17 tons. The motor has 10 poles, each weighing 2,200 lbs., and the generator 20 poles, each weighing 1,300 lbs. These poles aggregating 48,000 lbs, or 24 tons, revolve at 300 revolutions a minute. The motor rotor weighs 72,560 lbs., or over 36 tons, and the generator rotor 76,560 lbs., or over 38 tons. The section of the shaft between the two weighs 12,000 lbs., or 6 tons. The bottom half of the motor stator weighs 54,000 lbs., or 27 tons, and the bottom half of the generator stator 42,000 lbs., or 21 tons. Nine railway cars were required to transfer the material. The set composed of a 7,500 horse-power motor, driving a 5,300 k.w. generator, approximates 14,600 horse-power. It is interesting to note that there are really two transformations in the work of the machine, namely, from electrical to mechanical energy and back again to electrical energy suitable for the city. These two transformations are effected with a loss of less than 10 per cent., showing that the design was good, the construction adequate and the material of the best selection. There were already in the station five smaller 1,000 k.w. frequency changers, so that the capacity of the station is now doubled.



Giant Frequency Changer.

The work of erecting this heavy machine, which was in charge of Mr. Thomas J. Mullen, superintendent of construction of Allis-Chalmers-Bullock, Limited, presented unusual difficulties. As the crane in the station was only 15 tons capacity the heavier parts were all raised and lowered by means of jack screws. Part of the end of the building was taken down, and a runway was built from the railway to the foundation beds, and the machinery was brought in on rollers. The whole work was accomplished without mishap in 31 days.

Owing to the lack of space it was necessary to place the exciter set upon a platform about 12 feet high. This photo was taken before all the fittings had been added, such as railings around the platform and over the bearings. The smaller motor and generator in the foreground are one of a series of five sets of frequency changers, 1,000 k.w. each, in the station. The large one, as already stated, is 5,000 k.w. Allis-Chalmers-Bullock, Limited, Montreal, were the contractors for the whole installation.

TUNNEL THROUGH THE ALPS.

BY the completion of the Simplon Tunnel through the Alps, connecting Switzerland to Italy, on the last day of February, a great engineering feat has been accomplished. It is expected that the preparation of the tunnel for a permanent way will be completed within the present month. The length of the Simplon Tunnel from Briga, in Switzer-

land, to Iselle, on the Italian side of the mountain, is about twelve miles. A very hard formation of rock was encountered at the outset on the Iselle side, which rendered necessary the construction of special machinery. After the boring had been pushed about two miles, powerful cold springs were met, from which poured more than 500 gallons of water a

To ~~Own~~ Montreal
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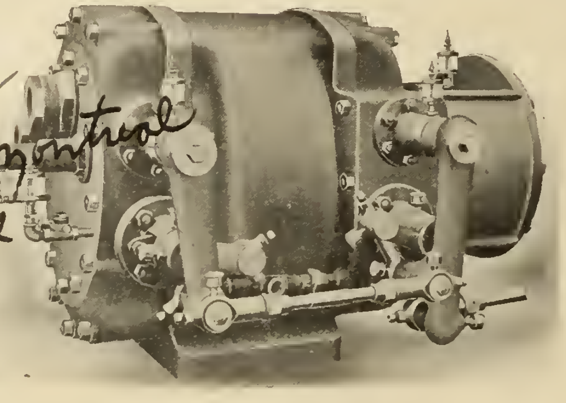


Corliss Engine Valve.

minute, and for a time caused a suspension of all work on the Italian side. Hardly had this difficulty been overcome when about 200 feet further on a stratum of shifting material was encountered, and the further tunneling of about 150 feet required six months' time and an expenditure of over $100,000. As the work proceeded it was found that the brick-work arch erected for the support of the finished portions of the tunnel was threatened with ruin, because of a slippery substance contained in the mountain's formation, and most of the work on the archway had to be gone over again. But the greatest difficulty encountered was last September, when hot water began to pour into the tunnel and caused a further suspension of work for several months, the temperature rising to 131 degrees fahrenheit. On the Swiss or northern side there exists an accumulation of water which has been a constant menace to the workmen. Now that the borers have met, this water can be drawn off. The Swiss and Italian Governments jointly financed the tunnel undertaking, share and share alike, at the cost of $15,000,000.

INLET VALVES FOR AIR COMPRESSORS.

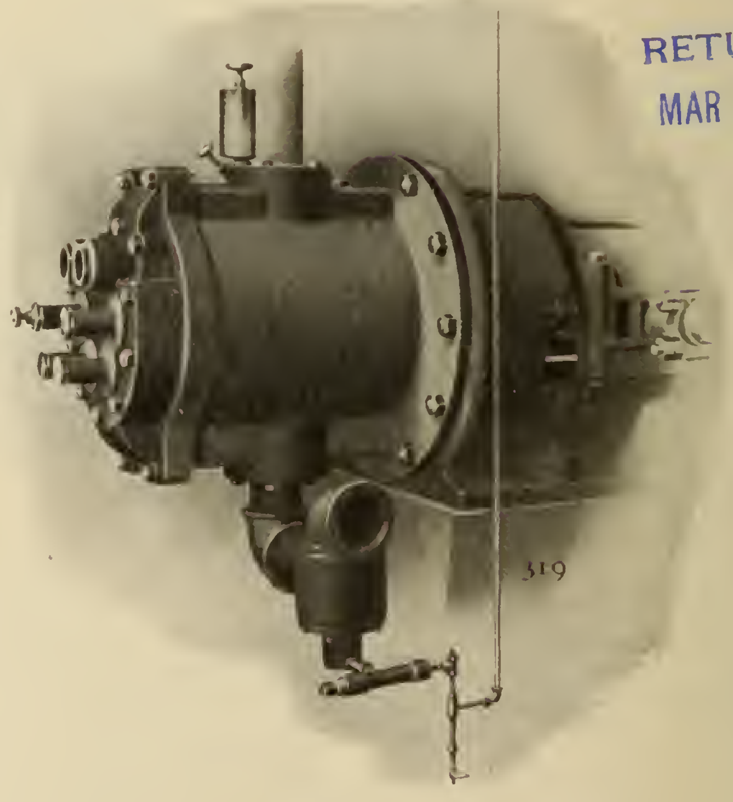
As the first requirement is to get the free air into the cylinder, the most important of the air valves are the inlet valves on the low pressure or intake cylinder. Good inlet valves should permit of very large passages leading to them, so that the free air will reach the valves practically unhindered. Then the port areas through the valves should be large, so that but little suction will be required to draw the air into the cylinder. The valves should be in the heads, so that the air will have little chance to get heated on its way into the cylinder. This heating of the intake air is a source of loss that should not be overlooked, for every five degrees that the air is heated before compression means a loss of one per cent. in capacity and a waste of one per cent. in power. When it is considered how easily air becomes heated by passing over hot metallic surfaces, it will be seen that there may in some cases be a large loss due to this cause. This loss is hard to measure, but for that reason every precaution should be taken to avoid it.

Inlet valves should close promptly when the crank passes the centre, otherwise some of the air will escape before compression begins. This slip is a very serious fault with some styles of valves, especially those which have neither gear nor springs to close them.

When closed, the inlet valves should not leak. Leakage is a fault which depends largely on the designs of the valve, as properly designed poppet valves and Corliss valves tend to become tighter as they wear. A valve which has a tendency to wear leaky is, of course, always getting worse, and should be avoided.

Clearance also causes a reduction of capacity, and should be kept low. Its importance is sometimes overestimated, for clearance represents a loss of capacity only, while suction heating of the air slip and leakage not only reduce the capacity, but waste the power. In addition to this, clearance is a constant quantity and may be completely covered by making the cylinder slightly larger in diameter, while the other losses mentioned are variable and may grow from bad to worse.

For the inlet valves on the low pres-



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Intake Unloader.

sure cylinders of the Canadian Rand Drill Co.'s compound compressors they have adopted a single-ported Corliss valve, driven by a special valve gear. With this gear we are enabled to get a quicker and wider opening for the same diameter of valve than can be obtained with any other positive gear now in use. This enables us to get a very large port area, usually twelve and one-half per cent. of the piston area, while at the same time the clearance is kept very small. The passages leading to the valve are still larger than the ports, usually from eighteen to twenty-five per cent. of the piston area. The valves are in the heads, so that the air does not come in contact with any heated surfaces before it enters the cylinder. Being positively driven, the valves close at the end of the stroke, thus preventing any slip. Being of the single ported type, and lying directly above the port, the valves tend to wear tight rather than leaky.

On power-driven machines is provided an unloading device in the intake pipe. When the air pressure rises to the limit for which the unloader is set, it shuts off the supply of air to the compressor and reduces the power required to the mere friction load. When the pressure falls a few pounds, the valve opens again, admitting air to the cylinder. This device may be adjusted to suit the pressure required while the compressor is running.

THE LAURIE TRIPLEX PUMP.

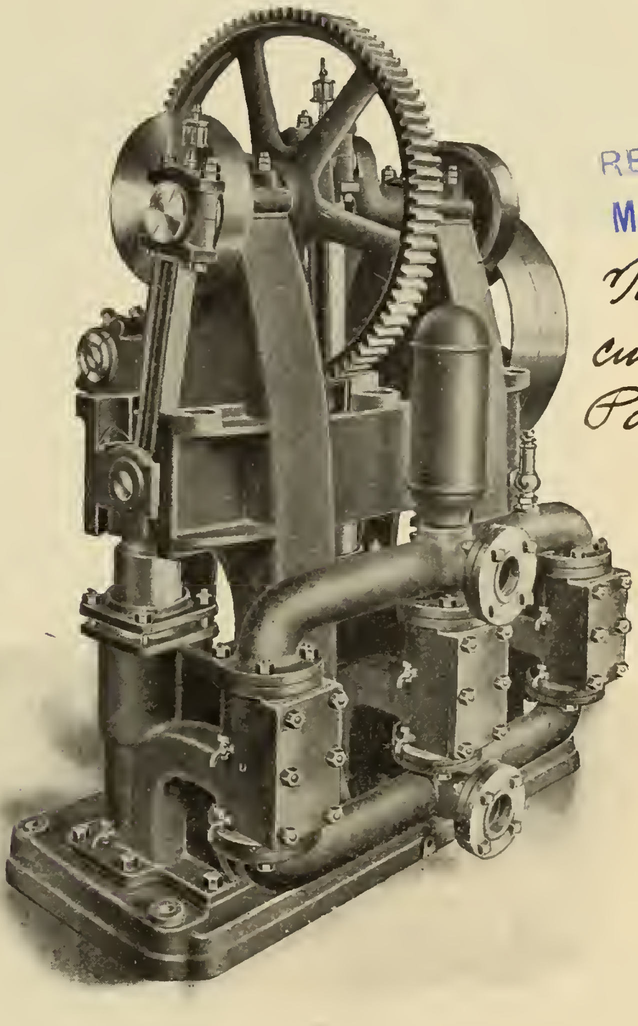
THIS pump, manufactured by the Laurie Engine Works, Montreal, is built to withstand constant running under extreme pressure, with little care or attention from an engineer, the most necessary consideration being to keep the oil cups filled with oil. The gears are machine cut and the plungers are trued and ground to a smooth finish and attached to an engine crosshead, which runs in boxed guides. It is also supplied with tight and loose pulleys so that when the pump is not required it can be stopped by merely shifting the belt. The three cranks are placed at 120 degrees, which assures an even flow from the discharge, with a minimum of power consumption. The pump in style and finish is in keeping with other lines manufactured by this company for some years.

The Laurie Engine Company are at present installing a 1,500,000 gallon triplex pump for the Town of Farnham, water supply to be operated by water wheel. This method of furnishing water might be considered more carefully by many towns throughout Canada, as any available source of water power could thus be utilized to the best interests of the city, and a plant such as Farnham is installing may be operated 24 hours a day, each day in the year, at a trifling expense in comparison with the cost of supplying water to a town which has steam power.

A GENERATING SET EMBRACING NEW FEATURES.

THE general design of the engine illustrated embodies all the latest improvements to the horizontal type. The reciprocating parts are substantially constructed and counterbalanced with lead load discs. A feature of construction is that of forging the crankshaft solid in one piece and shrinking the discs onto it. A special arrangement of the Rites' governor gives a regulation within 1 to $1\frac{1}{2}$ per cent. from full load to no load, and by a modification of the Marshall valve gear an adjustment of the cut-off from zero to 70 per cent. is attained. The main bearings, crankpin, valve stem and slides of this engine are well habbitted with the Sturtevant white metal. A recent and important improvement is that water-shed partition which prevents the water from the piston rod stuffing box from reaching the interior of the engine frame, and the oil on the reciprocating parts from being thrown out into the engine room. The main body of the engine is enclosed on both sides by removable plates, as may be seen from the cut, and the crank webs are enclosed in a cast-iron hood, having two holes with removable covers, one for the purpose of cleaning the crankpin box while it is in motion, and the other for removing the box without taking off the large hood. Between the watershed partition and the front end of the cylinder is a hand hole for reaching the stuffing box bolts without communication to the oil spaces.

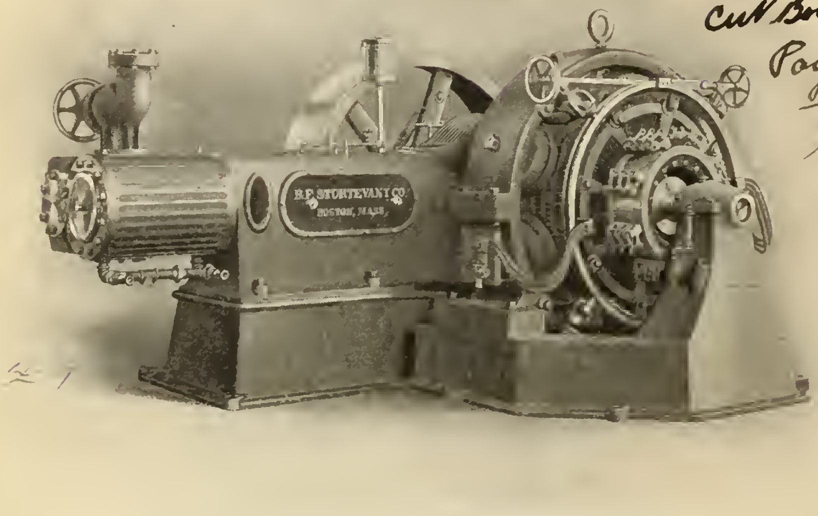
There are two oiling systems for this type of engine, the gravity or tank system and that by forced pump lubrication. With the gravity or tank system, shown in the illustration, an oil tank supplies the pipes leading to the parts to be oiled. At each point where the oil is delivered is a little gauge glass



Laurie Triplex Pump.

and valve for regulating the flow at that point. A valve just below the tank regulates the entire oiling system.

With the pump, or forced lubricating system, a pump is located in the base of the engine and is operated by the crankshaft. Oil is delivered from this



New Generating Set.

pump to the main bearings and from the main bearings through holes in the crankshaft and web to the crankpin. From this point the oil is conducted up through a hole in the connecting rod to the crosshead pin. A separate set of pipes conveys the oil from the crosshead guides to the valve stem guides. The pressure of oil in the bearings under this system will vary from 12 to 18 lbs. per square inch. The mechanical efficiency of the engine is so materially increased by this system of lubrication that its demand is rapidly increasing. Practically all engine builders will soon be obliged to provide for it to keep abreast of the time.

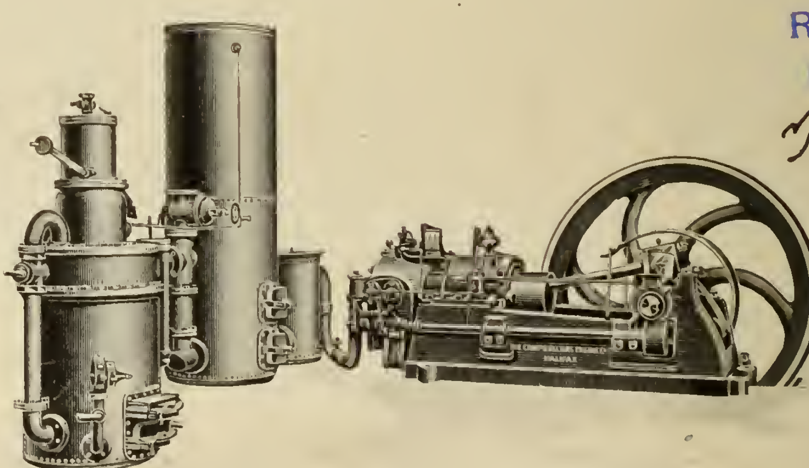
The generator of this set is of the eight-pole type, and is capable of carrying momentary over-loads of 50 per cent. without any shifting of brushes or flashing of the commutator and an overload of 25 per cent. for a period of two hours without undue heating. After a continuous run of ten hours at full lead the increase in temperature.

In the construction of the commutator only drop-forged or drawn segments are used, these being secured in cast iron shell of spider construction and clamped in place with a steel ring. No cast segments of any nature whatever are used. The segments are insulated with the best quality of carefully selected mica of a degree of hardness to allow the mica and segment to wear uniformly, obviating trouble from high mica. The end insulation consists of micanite rings and the whole commutator is assembled while hot, under great pressure. Carbon brushes only are used, the commutator being so proportioned and the brushes of such size as to allow at least one square inch of brush area to every 30 amperes carried. These brushes are carried in holders of most approved construction, each mounted upon a self-contained brush rigging so arranged that the entire set of brushes may be rotated completely around the commutator.

Hand wheels are furnished for adjusting the brushes in position, these hand wheels being so located that the brushes may be adjusted from either side of the generator. This generating set is manufactured by B. & F. Sturtevant, Boston, Mass.

SUCTION GAS PRODUCERS.

ONE of the developments in the production of the power which is being followed with greatest interest at present is the utilization of the suction gas plant in connection with the gas engine for producing power. To explain the matter simply for the benefit of those to whom the matter is new: The suction gas producer is actually a gas-making plant on a small scale, occupying small space, requiring a minimum attention and skill in its management, and producing power at a marvellously low cost. The engine and plant shown in illustration is taken from a photo of a 60 h.p. installation. The space occupied by this plant would be two sides of a room 22 feet x 16 feet. Gas is produced in the generator shown on the left hand side of cut. This generator is made of steel plates riveted together, it is lined inside with fire brick, leaving a space about 17 inches in diameter to contain the fire. The upper door shown is the fire door, and the lower one for the removal of ashes. After a fire has been kindled on the grate bars it is blown by a hand fan for five or ten minutes, when a further supply of fuel is furnished. The fuel used is the ordinary anthracite coal, pea size. After further blowing the fire until the necessary degree of heat is attained, the incandescent fuel through which the air is being forced by the fan begins to give off gas, which is a combination of carbon from the coal with



Gas Engine and Generator.

the oxygen of the atmosphere. This gas is further enriched by hydrogen produced by drawing steam through the fire. Steam is formed in the vaporizer, which is the chamber surrounding the upper part of the generator between the two

lines of rivet heads shown. This water chamber is open to the atmosphere, and when the engine commences running, the piston acts as a pump and draws or sucks (hence the name suction plant) the air through the water chamber, where it picks up the vaporized water or steam, and takes it down through the pipe shown on the left hand side of the generator and enters generator underneath the fire bars. The suction of the engine draws this steam and air through the incandescent fuel, producing, as above described, on gas which is then drawn through from the generator into hours or so. All the attention necessary can be furnished by an ordinarily intelligent man, and as it will only take about two or three hours of his time each day, a man who is engaged at other work in the factory could be used with advantage to look after the power plant.

Regarding the cost of running as compared with steam, the economy is so great that many people find it hard to believe, but as there are a very large number of these plants running in England, France, Germany and Holland, the data available is unquestionable. As an instance,

In another issue we will give further details as to the actual running costs of different installations. In the meantime we suggest to any of our readers who purpose making changes in or increasing their power plants that they could not do better than inquire fully into the merits of suction gas production before coming to a decision. The illustration used in this article represents the product of the Campbell Gas Engine Co., for whom Wayland, Williams & Dadson, Board of Trade Building, Montreal, aré the Canadian agents.

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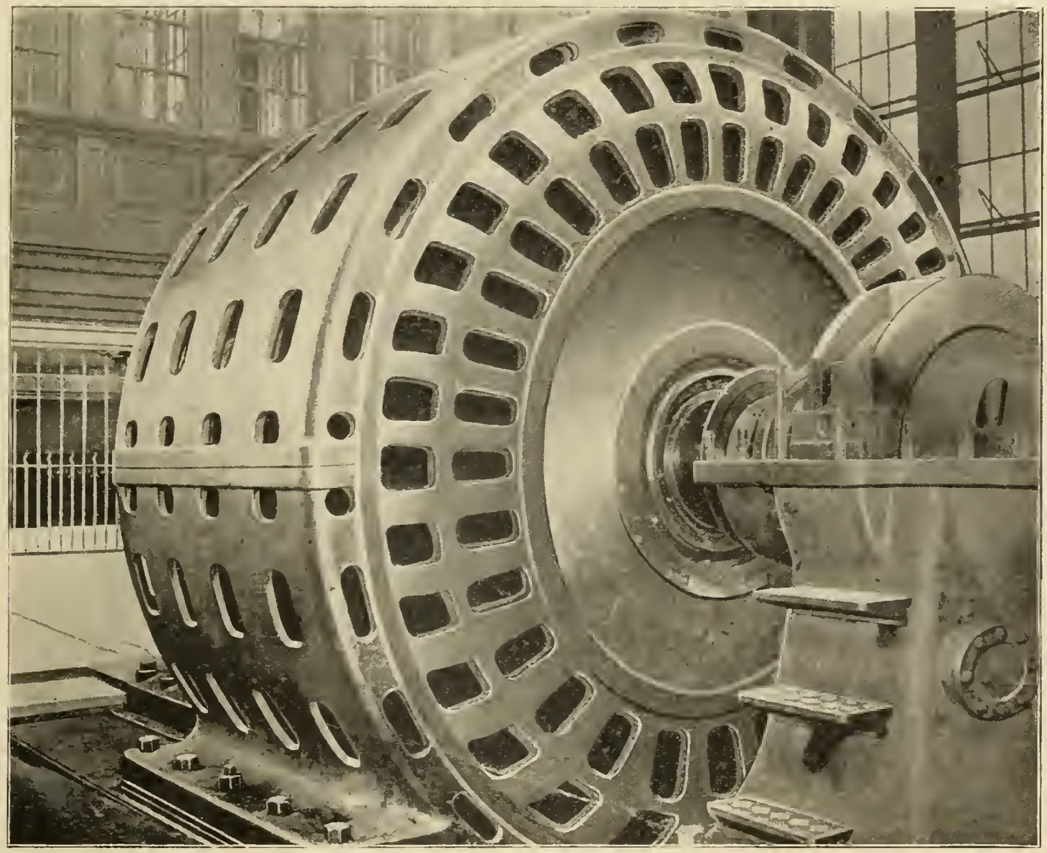

The Largest Turbo-Alternator in Service.

the coke scrubber, which is shown standing to the right of the generator. The scrubber is simply a tank of steel plates, which has been almost completely filled with ordinary coke. This coke is not consumed, but simply acts as a filter, purifying the gas to some extent and also by means of a constant stream of cold water sprayed through the coke, cooling the gas before it enters the gas box.

The action of the plant is entirely automatic after the engine has been started. All that is necessary to run the gas-producing plant is that a man should drop two or three buckets of coal on to the fire through the hopper every three an English firm who have installed a 10 h.p. gas plant, which is at work about eight hours each day with a constantly varying load, state that only 56 lbs. of coal are required to be fed into the apparatus each day. Their fuel costs them 20 shillings per ton; they therefore run the whole of their machinery for 12 cents a day. The ordinary steam engine will use all the way from 3 to 8 or 10 lbs. of coal per horse-power per hour. The gas generating plant, on the other hand, will give power on a consumption of fuel of 1 lb. of coal only per horse-power, and on the larger installation of less than this.

A RAILWAY MOTOR WITH A RECORD LIFE.

IN Western Ontario on the Sandwich, Windsor & Amherstburg Railway, there has been running for the past eight years an electric motor, during which time it has covered a distance of approximately 450,000 miles, and beyond the replacement of brushes re-metalling of bearings and turning up of the commutator, has not cost a penny for repairs. The only signs of wear seen are on the commutator which has been reduced 3-8 in. by trueing up. The wearing depth of the segments is 3-4 in., so that if the winding holds out as there is every reason to expect it will, the motor should last another eight years, and double its already remarkable mileage.

Something About Catalogues.

ANY CATALOGUE SPOKEN OF ON THIS PAGE WILL BE SENT UPON REQUEST. KINDLY MENTION CANADIAN MACHINERY.

A catalogue has been issued by Hervey R. Worthington, New York, on pumping machinery.

A bulletin issued by Wm. Albert Hall, Cincinnati, describes the "Bright" incandescent lamp.

The Galt Art Metal Co., of Galt, have issued a catalogue describing sheet metal for building purposes.

The Canada Cycle and Motor Co., Toronto, have issued a catalogue dealing with bicycles, accessories, etc.

An illustrated pamphlet on "Lumen" has been issued by the Lumen Bearing Co., 114 Jarvis street, Toronto.

The Loew Supply and Mfg. Co., of Cleveland, Ohio, have issued a catalogue on their grease and oil separator.

Catalogue No. 15C, has been issued by the Waterous Engine Works Co., of Brantford, dealing with chain belting.

Franklin Boiler Works Co., Troy, N. Y., have issued a catalogue illustrating and describing their water tube boilers.

The Ingersoll-Sergeant Drill Co., 26 Cortland street, New York, have issued a catalogue on air compressing machinery.

A stock list for January and February issued by the Scully Steel and Iron Co. is in booklet form and handy for reference.

Catalogue A, issued by Wescott Chuck Co., Oneida, N.Y., U.S.A., describes their patent lathe chuck and Little Giant drills.

The Craftan Storage Battery Co., Toronto, are sending out two instructive circulars dealing with storage batteries.

Catalogue No. 1 of the Moline Tool Co., Moline, Ill., is a handsome issue describing the machine tools made by them.

A catalogue containing 93 pages has been issued by the Stover Mfg. Co., of Freeport, Ill., describing hardware specialties.

A catalogue has been issued by the Macgregor, Gourlay Co., of Galt, Ont., describing and illustrating wood-working machinery.

The Williams Electric Machine Co., of Akron, Ohio, have issued a catalogue dealing with an electric safety clutch for machinery.

Bulletin No. 25 has been issued by the railway department of the Canada Foundry Co., Toronto, describing trucks for motor cars.

The Hamilton Motor Works get out a neat catalogue descriptive of the Triton marine engine, with specifications for launch hulls.

Morse, Williams & Co., Philadelphia, Pa., issue an instructive catalogue dealing with Hindley worm gearing and Hindley spirals.

A booklet has been issued by Brancher Bros., of Danville, Ill., describing the Little Giant Phenomenal Feed Water Heater and Purifier.

The B. Greening Wire Co., of Hamilton, Ont., have issued their catalogue for 1905 on wire rope, wire cloth, and perforated metals.

Bullard Automatic Wrench Co., of Providence, R.I., have issued a catalogue dealing with an automatic wrench manufactured by them.

North Bros. Mfg. Co., Philadelphia, Pa., have issued a catalogue dealing with the "Yankee" tools put on the market by them in 1898.

The engine catalogue of the Waterous Engine Works Co., Brantford, Ont., is an artistic production, describing the McEwen automatic engine.

A catalogue on Marsh Boiler Feed Pumps describes the piston pumps manufactured by the American Steam Pump Co., Battle Creek, Mich.

No. 32 catalogue of the Waterous Engine Works Co., Brantford, Ont., is a valuable acquisition to the literature dealing with timber cutting.

The enterprise of Clark & Demill, Galt, Ont., is shown in their recent issue of a handsome catalogue dealing with wood-working machinery.

Two catalogues have been issued by Graham, Morton & Co., Leeds, England, describing and illustrating machinery for handling material in bulk.

The Cushman Check Co., Hartford, Conn., in their January bulletin describe their universal geared scroll chuck, small geared scroll chuck and drill chucks.

Six illustrated catalogues have been issued by Darling Bros., of Montreal, dealing with heating apparatus, steam engines, motors, pumps, valves, etc.

A catalogue has been issued by the Scottdale Foundry and Machine Co., Scottdale, Pa., describing the Corliss engine, which is manufactured by them.

Gas Work vs Guesswork gives some straight talk on the merits of the Walrath gas engine made by the Marinette Gas Engine Co., Chicago Heights, Ill.

Circulars Nos. 1093, 1060, 1035 and 1090 have been issued by the Canadian Westinghouse Co., of Hamilton, Ont., dealing with transformers, generators, etc.

Kewanee Firebox Boilers is the title of a catalogue issued by the Kewanee Boiler Co., Kewanee, Ill., describing their boilers for steam and hot water heating.

A catalogue of 139 pages has been issued by the Metallic Roofing Co., of Toronto, describing by literature and illustrations the sheet metal building materials.

The National Oil Burner and Equipment Co., of St. Louis, have issued catalogue No. 4, descriptive of their oil burners and equipment, and also their steam traps.

Starr Mfg. Co., of Dartmouth, N.S., have issued their thirty-eighth annual catalogue, dealing with and illustrating the different kinds of skates manufactured by them.

A booklet giving the price list for 1905 of seamless steel enamelled hollowware has been issued by the Welsh Tinplate and Metal Stamping Co., of Llanelly, South Wales, England.

Butterfield & Co., of Rock Island, Que., and Derby Line, Vt., give some interesting information in their catalogue relating to screw threads, besides describing their screw plates, taps and dies.

Air and Gas Compressors is the subject of a 95-page catalogue issued by the Canadian Rand Drill Co., of Montreal. This contains valuable data, and should be in the hands of all power users.

The general catalogue of the Smart-Turner Machine Co., Limited, Hamilton, is devoted particularly to steam engines and steam pumps, and is descriptive of the different specialties made by this company.

A bulletin from J. B. Lippincott Co., Philadelphia, gives information regarding the Mechanical Engineers' Reference Book, a handbook of tables, formulas and methods for engineers, students and draftsmen.

Something Pneumatic is the name of a monthly magazine issued by the Chicago Pneumatic Tool Co., which gives illustrations of sand sifters, sand rammers, sand blasts, mechanical coal feeding devices, automatic oilers, etc.

The 1905 catalogue of Brown & Sharpe Mfg. Co., Providence, R. I., contains 194 pages descriptive of their high-class milling machines, grinding machines, automatic gear cutting machines, screw machines, cutters, automatic test tools and machinists' tools.

The 116-page catalogue of Boynton & Plummer, Worcester, Mass., describes the general features of their shaping machines, drilling machines, bolt cutting machines, portable forges, etc. A section of 26 pages at the back illustrates the detailed part of their output.

Labor Saving Tools Operated by Compressed Air is the subject of a series of bulletins being issued by the Ingersoll Sergeant Drill Co., New York, the first of which, describing the MacDonald rivet forge is just to hand. A small booklet received describes their Standard air compressors.

The Canada Chemical Manufacturing Co., Limited, London, Ont., haveissued in booklet form a paper on "The Supply of Water for Steam Boilers and the Prevention of Boiler Scale," by Prof. Jas. H. Bowman. It embraces much valuable information for anyone interested in boilers.

Machinery Development

Metal Working — *Wood Working*

PIPE THREADER MOTOR DRIVEN.

An interesting feature of the most modern shops is the absence of the network of shafts and belts which were an expensive, unsightly and dangerous part of the older ones. Instead, the practice is to use individual motors, directly connected to the different machines. The Bullock type of motor, built by Allis-Chambers-Bullock, Limited, Montreal, is especially designed for this and other similarly severe service such as electric crane and elevator work. In the design, no attempt has been made to turn out a cheap motor, but every effort was put forth to build the best motor of the class for their particular service. They are made either open or enclosed, as required. The enclosed, is dust and moist proof. The open motors are provided with screen covers, when necessary, for use on work where an open motor would not answer and an entirely enclosed motor is unnecessary. The illustration shows a Bullock type N motor geared to a pipe threader. These motors are operated on the Bullock multiple voltage system, which provides the only successful means of varying the speed of motor-driving machinery requiring variable speeds. An important feature of this system is that it lends itself admirably to existing installations. Any motors can be run on this system without any change, except to supply two or more different voltages and add the required controllers. The motors for this kind of service should, however, meet with certain requirements, and for this purpose, the Bullock type N motors are specially adapted.

A NEW SMOKE PREVENTER.

A RECENT invention being manufactured by the Chicago Pneumatic Tool Co. does the work of a smoke consumer, although it is really a smoke preventer. One has been installed in the engine room of Armour & Co., and although a roaring fire is kept up in the furnaces no smoke passes out of the chimneys. The mechanism is simple and is made to bolt on the front of any boiler. A large hopper with a flaring top and filled with fine pea coal has a revolving sprocket at the narrow bottom. This allows the coal to drop slowly into a chute below from which it is distributed evenly in all parts of the furnace. It is the coal that does not burn that makes the smoke and as this invention aids the fire in consuming all the coal, smoke is prevented and an even pressure of steam generated. The hopper is operated by the exhaust steam from the engine, very little live steam being found necessary.

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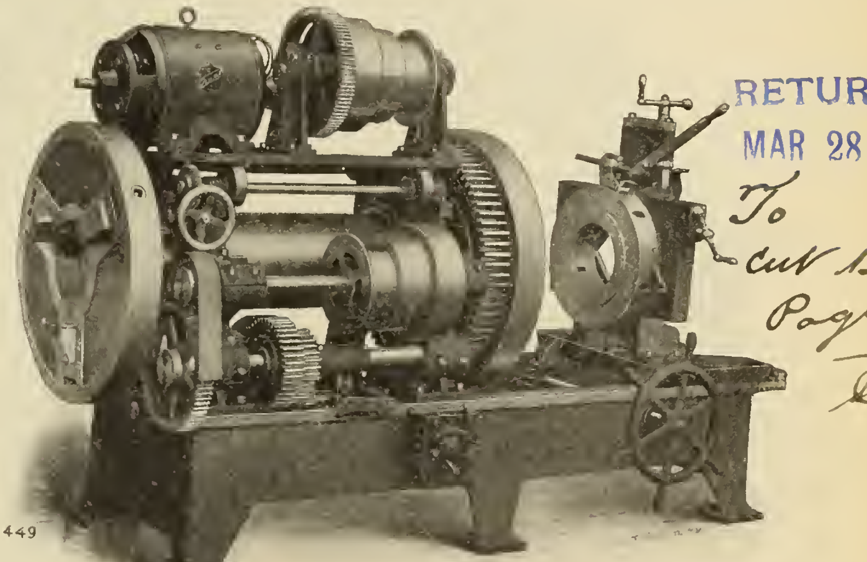


Motor Driven Pipe Threader.

AN ADVANCE IN ELECTRICAL MACHINERY.

W. A. JOHNSON, president and engineer of the United Electric Co., Limited, offices King street west, Toronto, has recently perfected and patented an improved type of multi-speed motor. Unlike the variable speed motors now in use Mr. Johnston's motor does away with pheostats and controlling contacts, and therefore is much simpler in operation than the types now in use. It gives minute regulation of speed within the range of the motor, i.e., on either 2 to 1 or 3 to 1 speed range. The degree of change may be within one revolution instead of within steps as in former methods of speed regulation.

Recently he has also patented new types of alternating and direct current generators, which, he says, are in design and theory of construction altogether different from anything now on the market.

To a representative of Machinery, he gave the first intimation of this departure from the ordinary rules and laws followed in motor and generator design.

These inventions in the electrical line will be novel in view of the fact that as far as new machine design is concerned there have been no new basic patents issued for many years. They are also of special interest in that the inventions are wholly of Canadian production, and the machines, when built, will be entirely Canadian.

END MATCHING MACHINE.

FOR some time past there has been a strong demand for an end matching machine. The Goldie & McCulloch Co., of Galt, who are extensive builders of wood-working machinery have felt that this demand would warrant the placing of such a machine

on the Canadian market. They have therefore built a machine to meet these requirements and have applied for patents covering the same. A very good illustration of the machine is given on this page. It is particularly designed for matching flooring and where hard woods are used the best results can only be obtained by using one of these machines. It is practically impossible for flooring to warp or twist at the end joint when matched on one of these machines. Not only will the joint be tight but the surfaces of the two boards are absolutely flush at all times. Unlike a side matcher all the cutters are saws. Four heads are used. One for the groove, one for cut-off and two for the tongue. All the heads travel while the table is stationary.

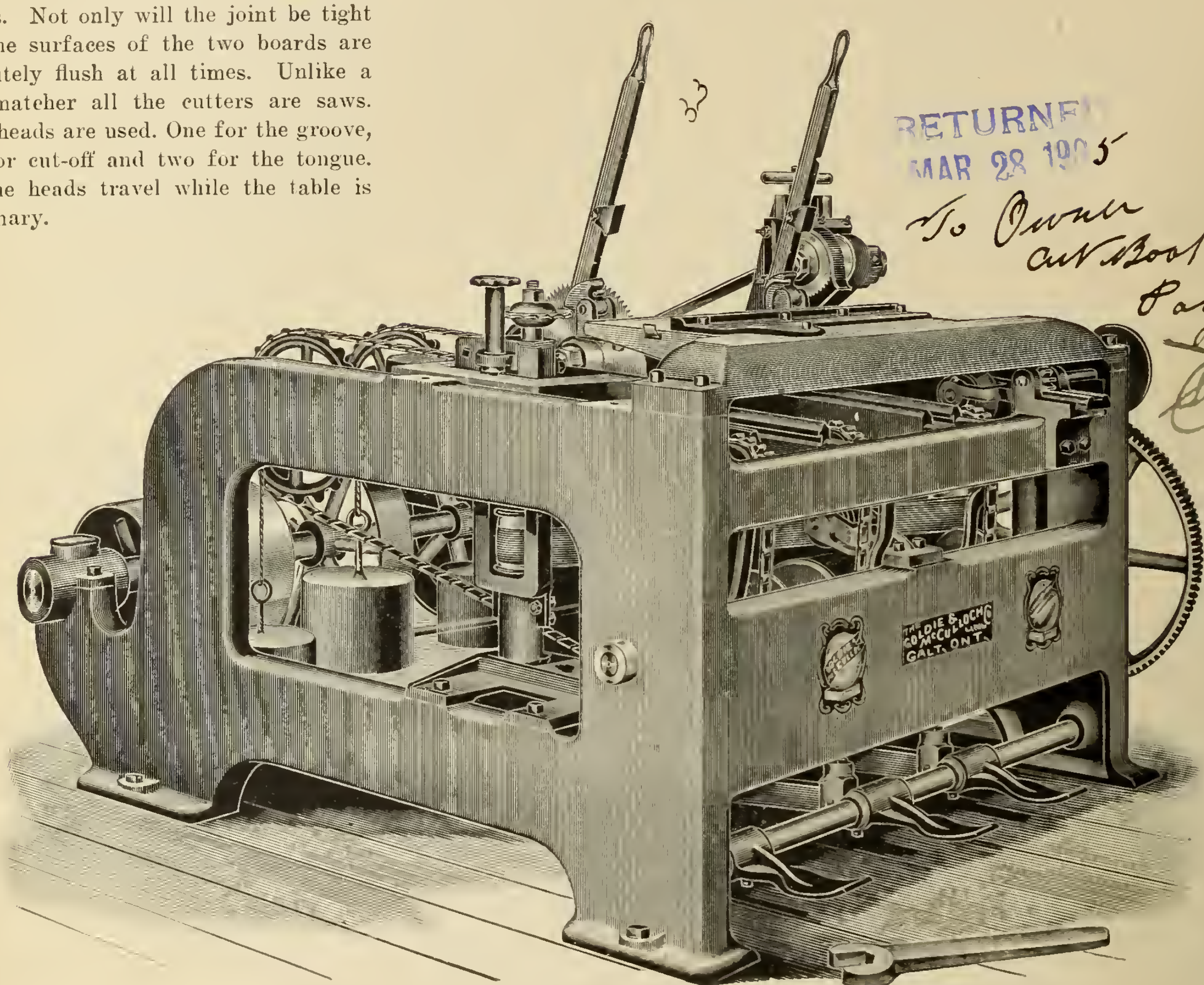
ordinary helper only, who can, with the aid of this machine, bend an amount of pipe to any desired complex curvature in one-tenth of the time that a skilful mechanic would require to perform the same amount of work with the aid of any device now in use or upon the market.

Being light in weight, it is readily carried from shop to job, or vica versa, and can be secured to any column, stan-

or tee bars, to any desired radius as easily as bending pipe.

When pipes are coated by the Sabin Process, galvanized, tinned, etc., this machine will bend such pipe to any desired shape without breaking the coating in any way.

One man can bend a piece of 2-inch pipe to an S bend in three minutes, no other assistance or device being used or needed.



End Matching Machine.

The Goldie & McCulloch Co. are to be congratulated on being the first to put a machine of this type on the market and from the inquiries received it is certain that many of these machines will be sold. It may be interesting to know that the company is the oldest manufacturers of wook-working machinery in Canada.

PIPE BENDING MACHINE.

THIS machine, while being of a somewhat simple character, will accomplish a marvellous complexity of work in line of its intended duty. Moreover, it demands the services of an

chion or any available support in a few minutes, or a suitable stand can be furnished, as shown.

Piping of steel, iron, brass, copper or other material can be bent cold up 2 inches diameter with one man.

It is indispensible in ship-yards, pipe shops, locomotive works, sugar houses and other places where pipe is used to any extent. Makers of heating plants, structural and architectural iron workers, fire escape manufacturers, will find this portable pipe bender especially useful; and also is well adapted by having special dies that can be readily attached for bending light angles, flats

The cost of repairs, where it has been used ten hours per day in ship-yards, railroad shops and other places, has been of so slight a nature as to be negligible quantity.

The machine is operated by a hand wheel, which carries a pinion. The latter engaging a quadrant gear, operates the bending quadrant. The pipe to be bent is held in position at one end by a U-shaped clip, while a pin or roller placed in the holes in the platen engages the other end. The placing of the pin or roller in the different holes in the platen governs the bends obtained.

This machine is manufactured by Pedrick & Smith, Philadelphia.

Pipe Bending Machine.

FORGED STEEL FLANGES.

THE greatest innovation in pipe work of recent years has been effected by the introduction of new forged steel flanges for Spiral Rivetted Pipe, manufactured by the American Spiral Pipe Works, for whom the Canadian Fairbanks Company, Limited are Canadian sales agents.

By their use, the difficulties which have heretofore hindered the use of flanged pipe have been overcome, enabling them to be rivetted absolutely tight and securely to the pipe. All danger of breaking from rough handling in transportation, connecting, etc., is entirely eliminated.

These new forged steel pipe flanges, herewith illustrated, for boiler work, are superior to anything yet produced, embodying as they do the many important features requisite for modern high pressure steam work. A heavy hub is forged on all screw flanges, and it is made of sufficient length to give a long perfect thread. The outside of the flange is finished with the proper bevel for caulking.

These flanges are finished exception-smooth, thus insuring perfect contact when attached to work, and an inspection will satisfy the most fastidious that they are the best that can be made.

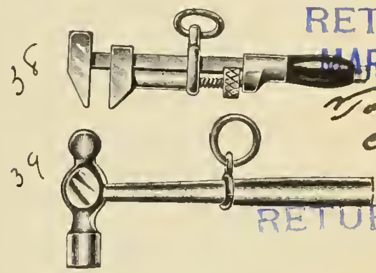
The threads of these flanges are tested with Briggs' Standard Gauges, thus insuring a perfect fit for standard wrought pipe.

Flanges are furnished flat or bent to the desired circle, and are threaded for wrought pipe unless specified plain.

Forged Steel Flanges.

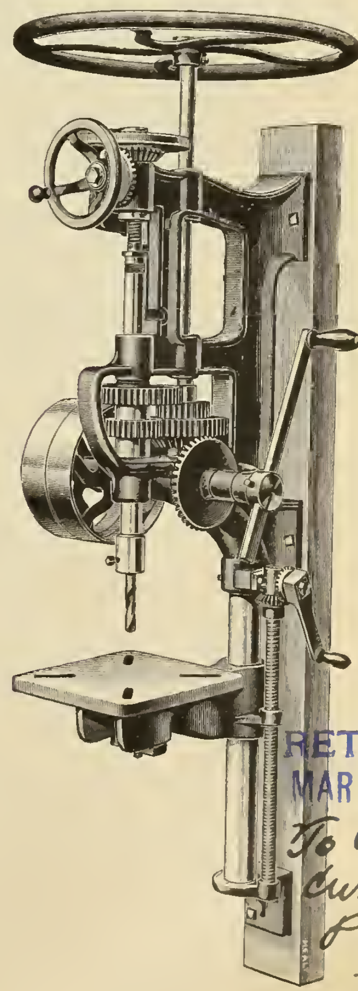
MACHINES FOR SMALL WORK.

IN every mill or factory of any pretensions, there is a machine shop devoted to repairs, chiefly on small work. About thirty years ago, Boynton & Plummer, Worcester, Mass., recognizing the extent of demand for machine shop equipment for this class of work, started manufacturing shapers, drills, bolt-cutters, and forges, especially for this purpose.



Model Tools.—A. C. Jenking & Co , Montreal.

In three decades that have followed, the firm have expanded until now, in addition to having an enviable reputation in the United States, they are ex-



Wall Drill.

porting steadily to various foreign countries, European and American.

While the number of lines made has been materially extended, until it now includes practically everything for general small machine shop work, the firm have confined themselves to this class of machinery, and so have been able to bring their tools to a high standard of efficiency in the special work each is designed to perform.

The drill shown in the accompanying cut is their No. 3 improved upright self-feeding drill. The cut gears of this tool are so arranged that a quick or slow motion may be given the drill for light or heavy work. This tool, together with the others made by Boynton & Plummer, is described in detail in their new cloth-bound catalogue, which will be sent on request to any reader of Canadian Machinery. Every machinist in charge of repair work should have this catalogue in his possession.

MANUFACTURING TURRET LATHE.

Recent developments in modern machine shop practice, and the ever-increasing and already extensive use of the new high-speed tool steels, have made the ordinary engine lathes of the past entirely inadequate to the greatly increased duties now imposed upon them. In order to meet these new conditions and demands, there has been designed and built by The American Tool Works Co., of Cincinnati, Ohio, U. S.A., a Manufacturing Turret Lathe, an illustration of which is herewith given. This lathe was developed especially for the use of automobile builders, gas engine manufacturers, and others having need of a powerful turret chucking lathe.

The bed is of deep section, of a patent drop-V pattern, which gives two inches additional swing, and has cross-box girders at short intervals its entire length. This construction gives exceptional rigidity.

The head stock is firmly bolted to the bed, and is very heavy. Spindle is of high carbon special steel, accurately ground, and has large hole throughout its entire length. Bearings are of best quality Phosphor Bronze (not babbit metal), with improved oiling facilities and with means for any necessary adjustment.

The carriage is very heavy, especially in the bridge, due to the drop-V bed, and has long continuous bearings on the ways. It is gibbed to bed its entire length. It has extra wide dovetail to give turret slide full bearing on carriage bridge, there being no overhang to turret. An easily-adjusted and very long gib is used on this slide.

Turret is very heavy, hexagonal in form, and provided with substantial locking devices of tool steel, located in convenient position.

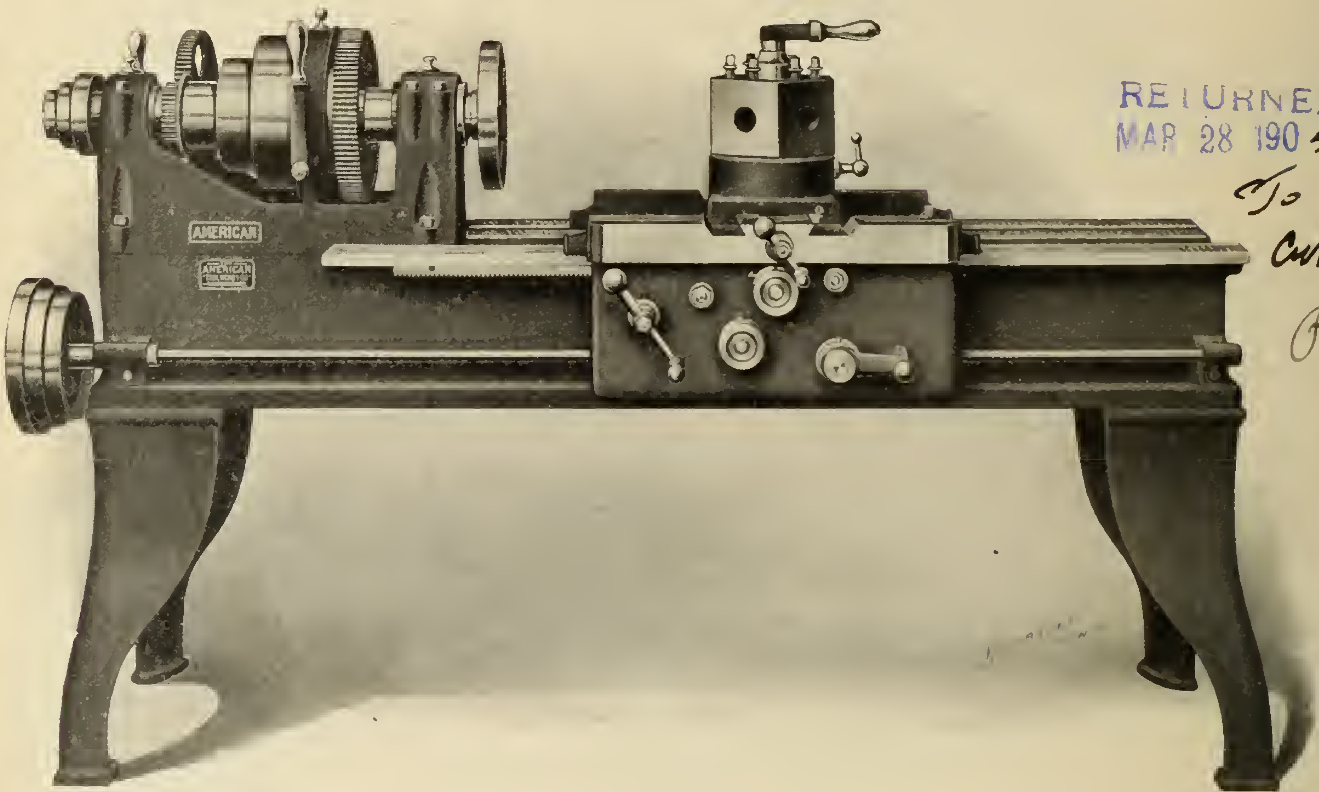
Feeds are three in number, both cross and longitudinal, obtained through belt-driven feed rod. Powerful friction locking devices are used in apron.

Convenient stop is furnished for properly locating turret centrally for boring.

The manufacturers can furnish this lathe in various sizes and with plain, back-geared or friction-geared head, belt or geared feed, with or without screw cutting features and other attachments usually furnished with engine lathes.

This is a very powerful, accurate, and simple tool for manufacturing purposes, is easily handled, and in all a rapid work producer and money maker. Some automobile builders have purchased as many as twelve of these tools at one time, showing conclusively what a valuable machine it is for the work in question.

Any further information will be gladly furnished by the manufacturers, or by any of the Fairbanks Company's offices throughout the Dominion.



Turret Lathe.

TO MAKE MACHINES IN TORONTO.

The W. R. Perrin & Co., Limited, manufacturers of hydraulic presses and machinery for factories, have purchased a lot 100x150 feet at 536 King street east, Toronto, opposite the car barns, and will erect a factory there to employ about fifty hands. For some years they have been doing manufacturing in a small way here, but business warranted a large increase in their manufacturing facilities.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

A new furniture factory is to be located at Stratford.

A giant ore crusher is being installed at the Granby mine at Grand Forks, B.C.

A new flour mill with 100-barrel capacity is being established at Uinga, Man.

The new factory of the Boston Last Company has been opened at Richmond, Que.

Fire did $30,000 damage to the Cobban Mfg. Co.'s factory in Montreal on Feb. 22.

Wapella, Man., has voted to aid the establishment of a grist mill and an abattoir.

Bowmanville has decided to loan $15,000 to the Durham Rubber Manufacturing Company.

Cement blocks will be used in the construction of the new Methodist church at Leamington.

Fire did $25,000 damage to Knight Bros. sash and door factory, at Burk's Falls on Feb. 22.

The Brantford Screw Company are considering plants for the erection of a large new factory.

The C. P. R. will build a new bridge between Edmonton and Strathcona, the cost to be $600,000.

The Joseph Laduc Gold Mining and Development Company, of Dawson, has gone out of business.

Gore & McGregor, Victoria, B. C., are having a survey made of pulp lands near Powell River, B.C.

A disastrous fire did $200,000 damage to the plant of the Crow's Nest Pass Coal Company a week ago.

A new factory will probably be built in Hamilton by the Vulcan Soot Cleaner Company, of Dubois, Iowa.

The Canadian Northern Railway will renew about 900 miles of track with 250,000 new ties this season.

Large blocks of buildings will be built this year in Winnipeg by Mrs. A. G. Hample and Mark Fortune.

Woodstock has voted in favor of granting a loan of $12,000 to the Eureka Planter Company of Windsor.

Two storeys will be added to the warehouse occupied by Tilden, Gurney & Co., on Rupert street, Winnipeg.

It is understood that work will commence at once on the new Windsor, Essex and Lake Shore Railway.

English interests have bought $2,000,000 worth of stock in the Montreal, Light, Heat and Power Company.

The Department of Public Works, Ottawa, propose to erect a new building on Wellington street in that city.

The Hamilton Brass Manufacturing Company are arranging to secure larger quarters for their Montreal branch.

Extensive lime kilns, with a capacity of 1,000 hogsheads per day, have been established at St. Hyacinthe, Que.

The Department of Public Works, Ottawa, are calling for tenders for the extension of a wharf at Quaco, N.B.

Tenders are being called for by the City Clerk of Montreal for a cafe and terrace to be built on Mount Royal.

A new school will be built at Victoria West, B. C., to cost $30,000. Eight large class rooms are planned.

The Brunswick-Balke-Collender Company have applied for a permit to erect a factory on Atlantic avenue, Toronto.

Henry Morgan & Co.'s departmental store in Montreal will be extended this Summer, the addition costing $250,000.

Work on the new Museum building at Ottawa has been commenced and $200,000 will be spent during the present year.

Efforts are being made to merge the Le Roi, War Eagle, Centre Star, Snowshoe and other mining interests in Rossland.

The Golden Ears copper and gold mine, at Pitt Lake, near New Westminster, is to be re-opened after a lengthy shut down.

A new felt shoe factory, to employ 40 hands, is about to locate in Brantford, occupying the plant of the Bailey Scissors Works.

About 300 men will be employed in the new works to be erected this Spring by the new Canadian Fairbanks Company in Montreal.

The Standard Art Company, Toronto, are negotiating with the village of Lakefield regarding the establishment of a furniture factory.

The St. John, N.B., Iron works have established repair shops for locomotives for the branch railway lines in the Maritime Provinces.

The Kingston municipal electric plant is offering cheap power at from 6 to 10 cents per kilowatt hour and light from 12 to 14 cents.

The Imperial Cement Co., Owen Sound, intend shortly to greatly enlarge their plant to meet the increasing demand for their cement.

It is reported that the old novelty factory at Clarksbury is to be converted into a factory for the manufacture of furniture for export only.

The Massey-Harris Company have embarked on the manufacture of hand cream separators in addition to their other lines of farm machines.

Tenders have been called for the enlarging of the boiler room of Alma College, St. Thomas, and the improvement of the heating apparatus.

Tenders are being called for for the new Alexandra Contagious Disease Hospital to be built at a cost of $120,000 at Point St. Charles, Montreal.

The snow blockade in Nova Scotia has delayed the work on the new steel rail mill at Sydney, but it is expected that the mills will be rolling rails by June.

The town of Grimsby is discussing the proposition of lending $15,000 to the Walker Steel Range Company, to induce the company to locate its works there.

The Lakefield Cement Company are enlarging their plant in order to utilize the water-power they have. The capacity of their plant will be increased one half.

The Manitoba Union Mining Company is advertising for sale 160 acres of natural cement lands and manufacturing plant on the Canadian Northern Railway.

Wm. Judge, who is building a saw mill at Wendigo Lake, near Temiskaming, has received an order for 100,000 feet of lumber from a copper mining company.

Whitby has voted to aid a new wind mill factory in that town. A by-law to aid the Farmers' Co-operative Harvesting Machine Company was defeated by nine votes.

The Canada Furniture Company are closing their branch factories at Stratford and New Hamburg and concentrating their works in Toronto, Wingham and Seaforth.

The Massey-Harris Company have applied for a permit for their new warehouse on the southeast corner of King street and Strachan avenue, Toronto, to cost $125,000.

Lymburner & Mathews have purchased a site on St. Francois and Berri streets, Montreal, where they intend to construct a large machine shop and factory at a cost of $20,000.

The C. P. R. have given an order to the Canada Foundry Company for several freight engines. Twelve locomotives were built by this firm last year, and gave entire satisfaction.

A very large building season is expected in Port Arthur and Fort William this Summer. A new industry to be established in the latter city is a large agricultural implement factory.

An explosion occurred at the Dominion Iron & Steel Co.'s works at Sydney last week by which No. 4 blast furnace was put out of commission for several days. No one was injured.

The new wharf at Esquimalt in connection with the proposed cannery of Messrs. Todd & Munsie, has been completed. Good progress is also being made with the buildings on shore.

The Canadian Northern Railway will spend a large sum of money this year on new terminal improvements in Winnipeg. The new station will be on the site of the old Manitoba Hotel on Main street.

Frederic Nicholls, E. R. Wood and D. E. Thomson, of Toronto, are interested in the formation of a new company, capitalized at $50,000, to supply gas and electricity to cities in Western New York.

Edward Bowser and Arthur Thompson, who have been running a woodworking factory at Mt. View, N.B., for the past year, have lately put in a steam power and intend enlarging their plant.

The annual meeting of the shareholders of the Intercolonial Coal Mining Co., Ltd., took place recently in Montreal. The output of coal and coke for the year ended 31st December, 1904, amounted to 269,676 tons.

D. B. Martin and Company of Philadelphia have purchased the Eastern abattoir on Frontenac street, Montreal, and will spend $150,000 in remodelling it so

as to make it one of the most efficient in the country.

Fire did $200 damage to the Kerr & Coombes' Foundry in Hamilton a few days ago, the firemen stopping it before much damage was done to the McClary Manufacturing Co.'s stock, which occupied the second floor.

Plans are being prepared for an extensive addition to the warehouse capacity of the Doherty stove works in Sarnia. The brick is on the ground and operations will begin as soon as weather conditions permit.

The Otis-Fenson Elevator Company will in future do all their manufacturing in Hamilton, where their plant will be doubled in capacity by the addition of $40,000 worth of machinery. The head office will be in Toronto.

The Canadian Railways Finance Company have acquired a Royal charter to connect Hudson's Bay with the Pacific by rail. It is understood the company purposes to undertake Canadian railway business on a large scale.

The A. C. Thompson Company, Limited, will establish a nail factory at Sydney, N.S., the capacity to be about 75,000 or 100,000 kegs per year. The raw material will be purchased from the Dominion Iron and Steel Company.

The Crown Brass and Steel Works, Stouffville, held their annual meeting last week and report a prosperous year. Negotiations are on regarding the sale of the business. Dr. Sangster is president and J. F. Lennox, secretary.

The first stamp mill product of the Shakespeare gold mine, to the value of between three and four thousand dollars, was shipped from Webbwood last week. Every indication points to the property as being a good-paying proposition.

A mica mine is being worked in Baffin's Land. According to A. P. Low of the Geological Survey Department, of Ottawa, there are also large copper and coal deposits in this territory and on the western shores of Hudson's Bay.

The acquisition of the Esquimalt and Nanaimo Railway by the C. P. R. has opened up a movement, looking towards the establishment of a smelter on the west coast of Vancouver Island, where valuable mineral deposits lie undeveloped.

It is likely a large hotel covering one block will be erected shortly in Montreal. The proposed site in the block bounded by St. Catherine, Peel, Metcalfe and Dominion Square. When completed it will be the best of its kind in Canada.

The Magnesia Asbestos Supply Company, of San Francisco, Portland and Seattle, has opened an office in Vancouver, and proposes to establish a branch factory there to manufacture asbestos covering for steam pipes for the B. C. market.

Vancouver millmen confirm the report of an advance in the price of lumber by the Pacific Coast Lumber Manufacturers' Association, averaging from 50c. to $1. This effect on the coast will be to restore the markets to some extent in the Northwest.

John Clark, of the firm of McDiarmid & Clark, lumber dealers, Brandon, Man., has returned from a business trip to the principal cities in the States and Eastern Canada, where he has been purchasing machinery for the company's new planing mill.

The Regina gold mine in the Lake of the Woods district is to be re-opened after being closed down for some time. A considerable quantity of machinery has been purchased and operations will soon commence. The mine is believed to be a good property.

At the annual meeting of the Montreal Steel Company last week the annual report for 1904 showed net earnings of $116,090. The four quarterly dividends on the preferred stock, at the rate of 7 per cent. per annum, amounting in all to $56,000, have been paid.

Pland for a new $30,000 building in Vancouver have been prepared, to be erected on Carrall street, on the site formerly occupied by the Ross & Howard foundry. The building is to be two and a-half storeys in height and will be used as a store and dwelling.

The output of the Dominion Iron and Steel Company, of Sydney, C. B., during last year, is stated to have amounted to 143,113 gross tons of steel of all kinds and 96,601 tons of pig iron. The company imported 222,000 tons of iron ore for use in blast furnaces.

The contract for building the new docks for Mackenzie & Mann at Port Arthur has been given to the Barnett-Record Company, Minneapolis, Minn. The docks will be equipped with the most modern handling machinery, and will have a capacity of 300,000 tons.

The annual report of the Wm. A. Rogers Company, Limited, showed net profits of $163,206, in spite of the enlargement of their plant at Niagara Falls. Dividends absorbed $72,000, while to the reserve was added $75,000, and to the realty and plant fund $17,485.

The Malleable Iron Works in Brantford are again running full blast after several days idleness in consequence of a scarcity of pig iron. Night and day gangs are on, and double the amount of malleables are being turned out. The company has a large railway contract on hand.

The May and Jennie Mine on Forty-nine creek, 10 miles from Nelson, B.C., is being equipped with a Hendryx cyanide agitator, 12 feet in size, capable of treating 50 tons a day. The mill will be running April 1st and the plant will cost between $20,000 and $25,000.

The first discovery of nickel ore in British Columbia has taken place in the Yankee Girl mine, near Ymir. A trial shipment will probably be made to the smelter at Sudbury. The Sudbury ores average 3 per cent. in nickel, while the Ymir ore is said to go 5.1 per cent.

Medicine Hat council will spend $22,000 in the erection of a municipal building. Accommodation will be provided for the fire department, council clerks, etc., on the ground floor. The upper storey will be a large hall. The basement will contain the police court and cells.

The Bank of Hochelaga has decided to erect a branch at the southwest corner of St. Denis and Mount Royal avenues, Montreal. The new building will be three storeys high. The contractors are Deguise & Lemay, for the brick work, and Labrecque and Mercure for the remainder.

The Malleable Iron Works Company, Smith's Falls, is thinking of enlarging its works considerably there, and has asked the council for some extra land and a fixed assessment for twenty years. A committee was appointed to consider the request and will report at next meeting.

The Victoria Lumber and Manufacturing Company of Chemainus have just completed an extensive water system to their plant, the installation of which cost in the neighborhood of $10,000. The pipe used in the system was manufactured by the Canadian Pipe Company of Vancouver.

The annual meeting of the shareholders of the Dominion Wire Rope Co., Ltd., was held in Montreal last week, the following officers being elected for the ensuing year: President, F. W. Fairman; vice-president and managing director, F. H. Hopkins; secretary-treasurer, J. J. Rosevear.

Fear is expressed by John Keen, president of the Mining Association of B. C., that there will be a general strike of the smelter men in British Columbia, owing to the defeat of the socialist eight-hour-day bill in the Legislature. Some smeltermen have already gone out at Boundary Falls.

The output of the collieries of the Crow's Nest Pass Coal Co. for the week ending March 10 was 11,830 tons, viz., Coal Creek, 10,001 tons; Michel, 7,122 tons; Carbonado, 1,707 tons; daily average, 3,138 tons. Total output for corresponding week last year, 14,139 tons, an average of 2,356 tons daily.

The snow blockade in Nova Scotia has prevented the shipment of steel from the works of the Dominion Iron and Steel Company at Sydney, and has also prevented the company from obtaining machinery intended for the rail mill. The company has booked heavy orders for rails from various sources.

The Peterboro City Council has granted a site and a fixed assessment of $1,000 to the Peterboro Cereal Company, a new industry which will manufacture cereal and shredded vegetable foods. A site and fixed assessment on $4,000 for ten years has been granted the Peterboro Shovel and Tool Company.

The Breckenridge & Lund Company's coal mine at Lundbreck, 40 miles west of Macleod, on the Crow's Nest branch of the C.P.R., has given a contract for their hoisting and developing plant, and expect to be in full working order by next July. A carload of bituminous coal is now being shipped daily.

The Canadian Northern is making active preparations to rush the laying of steel to Edmonton early next Summer. Messrs. Huff and Carter, of that city, have been awarded a contract for supplying 100,000 ties, to be delivered at Battleford before July 1st next. About 100 men and 25 teams will be needed on the job.

The exports of lead from Canada in 1904 were 12,913 tons of lead in ore, etc., and about 21 tons of pig lead. Exports of iron ore were 168,828 tons valued at $401,738. In addition to the ore exported about 180,932 tons of ore, worth about $489,687, were mined in Canada and charged to Canadian blast furnaces.

The outlook for the coming summer for the Nova Scotia Steel and Coal company at Sydney Mines is said to be the best for years. The company will

increase its output of coal by at least 50 per cent. A new battery of 40 coke ovens is to be opened next week and work is being rapidly pushed forward on the steel works.

Zinc was first specifically mentioned by Paracelsus in the sixteenth century, although it was certainly known to the ancients. The first of the moderns to actually produce metallic zinc from its ores was Henckel in 1721. The first zinc smelter of which we have any record was erected in 1740 by John Champion at Bristol, England.

The Kingston Street Railway Co. has passed into the hands of the bondholders, who held a mortgage for over $150,000. Hugh Nickle, the present superintendent, will assume the management. The company is now healing with the city for power, and is running the road on a limited service until April. There are seven miles of track.

The most notable news at Rossland recently is the report of the finding of a new ore vein in the White Bear. It was found in an upraise being made from the eight hundred to the seven hundred foot level. The ore is high grade, averaging $25 per ton, and ten carloads of it was extracted, and sent to the smelter during the week.

The Canadian Electric Light Company, Quebec, has been re-organized, and will make payments on its first debentures on March 16. The new officers are: President, Hon. L. P. Pelletier; vice-presidents, Rod. Audette, Gaspard Lemieux; directors, W. A. Marsh, Chs. King, H. M. Price, Et. Dussault, Geo. Demers and Jos. Gosselin.

The St. Eugene mine, according to The Victoria Colonist, produced more lead in 1904 than the combined output of the silver-lead mines in the Kootenay country. Since May last, when the St. Eugene resumes operations 68,500 tons of ore were mined, concentrating 14,500 tons and making a profit of $115,936. The lead bounty amounted to $91,661.

The first annual meeting of the Down Draft Furnace Company, Limited, was held a few days ago at Galt. The report of the year's business was very gratifying to the shareholders, while the prospects for future business are exceedingly bright. The new works of the company are now finished and equipped, and will be in operation in a few days.

The annual meeting of the Britannia Copper Syndicate, Limited, was held in Vancouver last week, reports being presented showing the satisfactory progress of their development work and the erection of wharves, concentrating plant, crushing mill, power house and aerial tramway. The plant is expected to be in thorough working order by May next.

Brockville will submit by-laws to grant bonuses of $30,000 in the shape of a loan to the Canada Carriage Company, and $1,000 for a site for D. H. Burrell & Co., Little Falls, N.Y. The latter propose erecting a factory for the manufacture of dairy supplies, while the former are rebuilding their burned factory, and guarantee to show a yearly pay roll of $60,000.

The ratepayers of Grimsby carried a by-law to lend the Walker Steel Range Company, Windsor, $15,000 for ten years, free of interest, and give light and exemption from taxes for the same period. The company will manufacture steel ranges in the old Grout foundry, and will employ 150 hands. Hugh Walker, head of the concern, formerly resided at Grimsby.

The Nova Scotia Steel and Coal Company at Bell Island, Newfoundland, will have put out 100,000 tons of ore for North Sydney alone this season, besides the quantity they have sent to Rotterdam and other points. Up to date they had landed at North Sydney 80,000 tons, and three steamers with a carrying capacity of 5,000 tons each will bring the balance.

The Keenan Bros.' Woodenware Manufacturing Company's plant has been opened. This industry is the latest addition to Owen Sound's increasing list of manufacturing concerns. The company has been incorporated with a capital of $100,000, and the chief articles of manufacture will be baskets and butter tubs. The factory will give employment to 100 hands.

According to D. D. Mann, 150 miles of the James Bay Railway between Toronto and Sudbury, will be in operation by September next. There are 1,200 men now employed on rock-cutting and other heavy work, while another large force is in the woods getting out ties. Five locomotives and 200 flatcars for construction work have been ordered for Spring delivery.

The White Pass and Yukon Railway, which has 110 bridges on its 110 miles of road operated, have placed orders for steel for three bridges. Many of these bridges cross small gulches, and where it is found to be practicable they are being replaced with concrete retaining walls and the spaces filled in. The steel bridges are to mark the passing of the wooden structures.

The need of an iron works on the Pacific coast has long been acknowledged, and there is now some talk of the C.P.R. establishing one on much the same basis as those at Sydney, C.B. Fields of iron ore are very prolific on the Island of Vancouver, and especially along the line of the Esquimalt and Nanaimo Railway, which was recently acquired by the C.P.R.

It will be conceded that the year 1905 has started in well from a pig iron producing standpoint in the United States. The output for January was approximately at the rate of 21,000,000 tons annually. February promises an even better report, for several new furnaces of large capacities have blown in and there is effort everywhere to get out the largest possible tonnage.

The Canada Malting Co., of Toronto, has just completed the purchase of a site west of McPhillip's street, on the C.P.R. Pembina branch. The company purposes starting business on a large scale this season. It will erect an elevator of 150,000 bushels capacity, and the necessary malting houses for the prosecution of their business; they will employ from 75 to 100 men.

Owing to the development of the cream separator trade in Canada, the Sharples Separator Co., of West Chester, Pa., has established a special Canadian selling organization with headquarters in Toronto, and will probably erect a branch factory in Canada in the near future. Edward Ellwood, Eastmure and Lightburn Building, has been appointed Canadian manager.

The board of governors of the Royal Victoria Hospital, Montreal, in trying to secure a lath to replace the wooden laths, some of which were destroyed by the recent fire, have approved of the expanded metal lath, manufactured by the Pedlar People, of Oshawa, Ont., and have given an order to this company to supply a sufficient amount to replace the entire amount of wooden laths.

The Dodge Manufacturing Co., of Toronto, manufacturers of power transmission machinery, have secured a large order for machinery from the Grand Trunk Railway system for their new million bushel grain elevator at Windmill Point. The Dodge Company has also supplied the immense steel marine leg for the new Harbor Commissioners' elevator, on Montreal water front.

The John Deere Manufacturing Company, who employ 7,000 men in their agricultural implement works at Moline, Ill., are negotiating with Mayor Rutledge, of Fort William, with a view to securing a site and building a large plant there. Branches are also proposed for Eastern and Western Canada, Fort William being considered an excellent shipping point for both east and west.

Plans are being drafted in Winnipeg by J. D. Atcheson for the construction of a seven-storey apartment block on the corner of Edmonton and Graham avenue, which will contain thirty suites of apartments arranged in suites of from two to six rooms. Plans have also been prepared for a building on the corner of Broadway and Edmonton. These two buildings represent an outlay of $150,000.

Property in Edmonton is becoming valuable. The National Trust Company have purchased from McDougall & Secord a lot 50x108 on the corner of Jasper avenue and First street, which is recognized as being the future centre of the city. The price paid is understood to be $20,000, the largest amount yet paid for a single lot in the city. The company will soon erect a large business block.

The International Coal and Coke Company's mine at Coleman, Alberta, shipped 51,000 tons of coal and coke during 1904. They have a battery of 104 standard beehive coke ovens, four 100 horse-power boilers, two 250 Kilowatt Westinghouse electric generators, and a compresser with a pressure of 1,000 pounds. The company expect to produce 2,000 tons of coal per day before 1905 is over.

A new building, measuring sixty feet by forty feet and costing $20,000, is to be erected at the northwest corner of Notre Dame and Dollard streets, Montreal. The external walls are to be of Montreal stone and Laprairie brick, banded with stone. The contractors are Louis David, for the mason work; the Dominion Bridge Co., for the steel work, and Jos. Cote, for the carpenter and other works.

Last year's mineral report shows an increased output from British Columbia placer mines, while a small production was obtained from the lode mines. The ore shipped from Rossland and vicinity, the chief gold producing district, were less by about 20,000 tons. The Yukon output for the year is placed at $10,000,000. The lead production was about 19,000 tons, as compared with 9,070 tons in 1902.

One of the principal articles of importation into the Philippine Islands just now is cement, and the business is well worth the serious consideration of

the trade. Whereas in 1902 the total value of the cement imported was $65,000, during the first five months of 1904 the importation reached a value of $72,000. The bulk of it comes from Hong Kong, but Belgium, Germany and the United Kingdom also participate in this increasing trade.

The 18th annual general meeting of the shareholders of the Eddy Company was held at Hull last week, the original board of directors being again re-elected. Mr. E. B. Eddy, president, Mr. S. S. Cushman, vice-president, and Mr. W. H. Rowley, treasurer. It is stated positively that there is no foundation for, nor any truth in, the report of the Eddy Company selling out to an American or any other syndicate.

The British Columbia Electric Railway Company, of Vancouver, will have a large amount of building during the present year. New depot buildings and a substation will be necessary in connection with the new Lulu Island branch. The new substation will be a sort of diminutive replica of the large substation on Westminster avenue, which was built last year. This building, from the standpoint of scientific structural design, is one of the finest in the city.

The annual meeting of the Peterborough Lock Manufacturing Co. was held last week, the reports presented showing the affairs of the company to be in a very satisfactory condition. The works have now been in existence nineteen years. The usual dividend of six per cent. was declared. J. R. Stratton was re-elected president, A. L. Davis vice-president, and the directors are: W. G. Morrow, Thos. Fortye and Wm. Irwin.

The Halifax Electric Tramway Company statement for the year December 31, 1901, shows net earnings of $137,523.34, 5 per cent. dividends on the capital stock is absorbed $67,500, $3,159.47 was spent in interest, and out of the year's earnings $66,863.77 was transferred to surplus account, which now stands at $162,015.73. The company has made steady progress, and the shareholders seemingly are warranted in expecting a higher rate of dividend in the near future.

The total assets of the Winnipeg mine, situated three miles east of Phoenix, and connected with the Phoenix branch of the C.P.R. by a spur, have been sold for $25,000 to W. S. Hunter, of Greenwood, and others. Old miners believe the Winnipeg mine has a large body of iron ore having gold value, a product much required by smelters. The Winnipeg has 5,000 feet of development, including 350 feet shaft, and much drifting. There are also new buildings and good machinery, including air compressor, hoists and pumps.

The imports of foreign coke into Belgium during last year amounted to 338,791 tons, as compared with 308,877 tons in 1903. The bulk (292,725 tons) was supplied by Germany, 15,166 tons coming from France and only 582 tons from England. The exports of Belgian coke advanced from 811,142 tons in 1903 to 879,798 tons last year. Of this total, France took 171,677 tons, Luxemburg 224,657 tons, Germany 86,305 tons, and Holland 55,829 tons.

At the annual meeting of the Hamilton Cataract Power, Light and Traction Company on Monday, it was decided to go ahead with the extention of the radial from Burlington to Oakville at once. The following officers and directors were re-elected: Hon. J. M. Gibson, president; James Dixon, vice-president; J. R. Moody, treasurer; W. C. Hawkins, general manager and secretary; J. W. Sutherland, J. A. Kammerer and John Dickenson, ex-M.L.A., directors.

The Canada Carriage Works, of Brockville, whose plant was partially destroyed by fire early in January, has regained its feet, and is going ahead as if nothing had happened. Buildings have been erected to take the place of the ones burned, and a full staff is employed in all departments. The output of finished goods averages more than one car-load daily. The firm state that Spring orders will be delivered according to contracts.

Thirty-five tons of iron ore are being shipped daily from the Williams mine, the first iron mine in the immediate vicinity of Sault Ste. Marie. The ore is claimed to be of Bessemer quality, and it is predicted that within a short time Minnesota and Michigan ore will not be needed there. It is also announced that a second mine will be opened 25 miles below the Soo within a few days, the product to be used by the Lake Superior Ore Corporation.

The annual meeting of Rhodes, Curry & Co., Ltd., was held recently. The report of the directors was read and adopted and a dividend of six per cent. was declared, which, on account of the increase in the capital stock of the company, is equivalent to the twelve per cent. paid last year. The directors' report showed that the volume of business for the year was $2,300,000. The receipts last year from the sale of cars were $1,400,000. The amount paid out in wages was $367,000.

The Red Cliff Lumber Company, a wealthy concern with headquarters in Duluth, Wis., intend establishing a large lumber mill at Rainy River, and work for a large export trade in rough and finished lumber. Representatives of the company have made several trips through the Canadian side of the Rainy River valley with a view to the purchase of timber limits, and Mr. F. L. Gilbert, who represents the company, leaves shortly for a European trip and proposes establishing offices in London and Liverpool.

The first payment of bounty on steel rails has been made by the Department of Trade and Commerce, a cheque for $60,000 being sent to the Consolidated Lake Superior Company. The claim was for 20,000 tons of rails which have been turned out, although it was never the intention of the Government to have given a bounty as well as a duty upon steel rails. The Auditor-General, however, upon the advice of Mr. Aylesworth, K.C., allowed the claim of the rail manufacturers under the act providing a bounty on structural steel.

The great Clergue enterprise, the Michigan Lake Superior Power Company is to have a rival. The Edison Sault Electric Company will put up a big power plant on St. Mary's Rapids, near the locks. They will expend $120,000 during the present Summer. The first section is to have a capacity of nearly three thousand horse-power. Mr. Alex. Dow, of Detroit, with several Wall street capitalists, is behind the move. It is the intention to ultimately use every bit of power in the St. Mary's River, amounting to half a million horse-power or more.

The report of the Port Hood Coal Company, just issued, shows that last year's output was only 62,335 tons. The directors had expected to make a contract for 150,000 tons, and relying on this, neglected to retain their previous trade. The company went in debt $60,062 during the year, including $12,000 of the company. Two miles of survey made for a three years' option, on the exercise of which preferred shareholders would be paid their $250,000 capital, and the common shareholders $45,000. This will be considered at the adjourned annual meeting, March 11.

The eighth annual report of the War Eagle Consolidated Mining & Development Company, for the year ending December 31, has just been issued. The financial statement shows assets of $2,308,151.61, the mines and mineral claims being valued at $1,699,329.39. The year's operations show a profit of $83,153.93, of which $27,797.78 was applied to interest on the indebtedness and $19,903.98 was written off for depreciation, leaving $40,157.17. The cost of ore production was brought down to $2.24, and the total cost of mining, including development work, to $3 per ton.

The discoveries of iron ore and aluminum in Central India are officially confirmed, and it seems likely that they will revolutionize industrial India. A rush has commenced to stake out aluminum claims, and a company, with a capital of over $5,000,000, backed by the wealthy Parsee Tatta connection, is being formed to erect blast furnaces and coking plants. Three million tons of the finest iron ore have already been proved to be in the new fields, while coal and limestone are within reach, and also enough easily worked aluminum ore to supply the present needs of the world.

Among other timely topics discussed at the Victoria Board of Trade recently was the proposal to place a duty on lumber exported from the United States to Canada. Statistics were given showing the amount of lumber used in Winnipeg during the past year, and it was stated that the greater part of this lumber had come from the States. It was demonstrated that had this lumber been the product of British Columbia mills it would have meant thousands of dollars for the province, which had instead gone over to the American side. The same thing was going on all over Manitoba and the Territories.

The Cape Breton Coal, Iron and Railway Company are hastening the development of their mine at Broughton. They expect in a few days two powerful air compressors and two fans of large size for their air shafts. Nearly two hundred men are now employed about the colliery and on the railway. The road is surveyed about three miles toward Sydney, and this end will be finished by the first of June. In a few days a force of men will arrive from Pittsburg to go on with the steel structural work at the bank head and installing revolving tipples. The mine is working on a double shift.

The town of Morrisburg will vote on a by-law to aid the Canada Steel and Tinplate Company. If the by-law carries, it will authorize the council to borrow $76,100, to be used for electric development purposes, and divided as

follows: $30,000 to the government for developing the water power; $38,750 for electrical machinery; $5,100 for transformers, and $2,250 for land. The company's side of the agreement is to erect eight mills at a cost of $300,000, to employ about 400 men, and to buy from the village the surplus electric power (estimated at from 400 to 500 horsepower) ar $12.50 per horse-power.

The final agreement has been signed between Mackenzie & Mann and the town of Port Arthur for the new million-dollar steel works to b? known as the Atikokan Iron Company, organized for the purpose of mining iron ore, and manufacturing pig iron and other products of iron and steel at Port Arthur. This company will be supplemented by the Canadian Coal & Ore Dock Company, which will construct coal and ore docks at a cost of $500,000. Of the $1,000,000 bonds of the iron company, Mackenzie & Mann have subscribed for $400,000; the town of Port Arthur, $300,000, and a group of American capitalists the balance.

The Collingwood Shipbuilding Company has within the past few months spent about $50,000 in plant. Its foundry and machine shops are now nearly completed, so that the company is able to do all parts of its work on its own premises. It has just closed a contract for a five hundred horse-power compound Corliss engine for the Chatham flour mills. The dock and inner harbor are full of vessels undergoing repairs, steamers are now beginning to fit out for spring and the harbor presents a busy appearance. Mr. J. M. Hopkins has been chosen temporary president of the company and Thomas Long secretary-treasurer.

A big project to develop the water-power of Grand Falls has been laid before the New Brunswick Government. The capitalists interested are those comprising the Electric Manganese Company, and include Barton E. Kingman, of New York, and Fred. Sayles, of Providence, R.I. The project includes the manufacture of ferro manganese at the falls and the operation of pulp, paper and saw mills, the operation of international railway by electricity and the transmission of electric power between the St. John River Valley, to be sold for use in lighting and manufacturing as far as St. John. The project will involve from $3,000,000 to $4,000,000 outlay.

The Northern Iron & Steel Company, whose issue of $2,500,000 capital stock has attracted considerable attention, has purchased the Open Hearth Plant and Rolling Mills erected at Collingwood by the Cramp Steel Co., Limited. The plant is capable of making one hundred tons of open hearth steel per day, and finishing the same into merchantable product, such as wire rods, bars, rounds, flats, skelp, tire steel, angles, bolt and nut material, fish plates, tie plates, angle bars, railroad spikes and material used in the construction of street and railway cars and locomotives; steel used in the construction of agricultural machinery and in the building of engines, bridges, etc.

There has been considerable renewal of activity in mining operations in Central Ontario recently, and many of the companies have made large increases in their plants. The Kingston Felspar Mining Company, at Bedford, purchased from Allis-Chalmers-Bullock, Limited, Montreal, a hoisting plant, including a 30-h.p. double-cylinder Lidgerwood engine; James Richardson and Sons, zinc miners, Mountain Grove, purchased an Ingersoll-Sergeant air compressing plant, and the Madoc Mining Co. at Tweed purchased a complete mining plant, consisting of a horizontal return tubular boiler, Ingersoll-Sergeant air compressor, Lidgerwood hoisting engine, etc., both from Allis-Chalmers-Bullock, Ltd., Montreal.

The Wilkinson Plow Company has purchased the West Lorne Wagon Works, and will run it in connection with their plant at Toronto Junction. This company was chartered last March and succeeded the business of the Walkerville Wagon Co., which built factories at West Lorne. The works were under the supervision of William and John Milner, who will remain with the present owners. All kinds of heavy wagons will be made at this factory. The factory is in a good hardwood section, and the Wilkinson Plow Works will be the selling organization behind the factory. The purchase was consummated by E. G. E. Ffolkes, manager of the Wilkinson Company, and the price is said to have been $75,000.

The Canadian Pacific Company have closed a contract for the transportation of 10,000 tons of spiegel from Liverpool to Sault Ste. Marie, Ont., which is the first contract of its kind made by a Canadian company. The contract was brought about by the Algoma Steel Co. purchasing 10,000 tons of English spiegel to be used in the manufacture of pig iron at the steel-rail mill. All the rail mills in America use a certain amount of English spiegel, and as the Lake Superior Corporation had opened up their coke blast furnaces they also secured some. The first shipment of 5,000 tons was brought over on the steamer "Lake Erie" and "Lake Manitoba" and shipped to the Sault over the Canadian Pacific Railway main line.

"If the conditions prevailing at the present time hold out throughout the year, and there is every indication that they will, the output of pig iron in Canada should show a substantial increase over all previous years," was the statement made by Mr. Ingalls, of the Geological Survey, at the annual meeting of the Canadian Mining Institute. A special report to be submitted at the meeting showed that the total output of pig iron in Canada in 1904 was 270,942 tons, against 265,418 tons in 1903, and 319,557 in 1904. Of the total production in 1904, 251,671 tons were made with coke, and 19,271 with charcoal. In the first half of the year the output was 120,643 tons, and in the second half 150,299 tons. The reason for the substantial increase looked for this year is that there will be two steel rail mills in operation, one at the Soo and the other at Sydney.

Mr. N. W. Rowell, K.C., has contradicted the report that the recent meeting of the Michigan Lake Superior Power Company affected seriously the financial affairs of the Canadian company. The Lake Superior Corporation was the owner of the second mortgage bonds of the Michigan Company, but most of the money spent by that company was raised by the sale of first mortgage bonds which were subscribed principally in Philadelphia. Mr. C. D. Warren, as receiver of the company, attended a meeting of the first mortgage bondholders and reported that it was necessary to expend a large additional sum on electric and hydraulic equipment if they were to realize the full benefit of their investment. A committee was therefore appointed to investigate the matter. No matter what might be done, Mr. Rowell said, it would in no way affect the Canadian industries at Sault St. Marie or their operation.

The following table, showing the world's lead output, was recently compiled by United States Consul Smith, of Victoria, B.C. It shows that Canada's production is comparatively low, while the United States leads the world in the production of pig lead. The production of the world, according to the latest reports obtainable, in English tons, during the years 1901, 1902, and 1903 was as follows:

Country	1901. Tons.	1902. Tons.	1903. Tons.
United States	260,059	259,780	266,691
Spain	166,792	174,936	172,521
Germany	118,862	136,703	141,558
Australia	95,000	104,000	93,500
Mexico	85,000	95,000	95,000
England	35,134	25,504	30,958
Italy	25,415	25,350	22,239
France	20,690	18,522	19,500
Belgium	18,441	18,050	20,015
Greece	17,502	13,840	13,075
Austria-Hung'ry	12,009	13,307	13,953
Turkey	2,200	3,622	7,493
Canada	10,300	8,335	8,121
Japan	1,000	4,000	4,000
Sweden	968	826	661
Russia	400	300	100
S. America	2,125	225	150
Africa and East India	100	100	165
Total	875,000	902,100	910,000

Nova Scotia Mine Sold.

The property of the Canada Coal & Railway Company at Joggins, N. S., which went into liquidation last year, was sold at Amherst to-day, at the instance of the bondholders. The purchaser was Stuart Jenks, barrister, of Amherst, acting for outside capitalists, said to be Americans. The purchase price was $50,500 for the mining property, which includes the line of railway from MacCan to Joggins, and large coal mines in splendid working condition at the latter place. The property is valuable. Montreal capitalists were largely interested in the company, which had been unfortunate in management. Timber lands embracing 1,900 acres were sold for $5,500. The latter amount will be devoted to liquidate the unpaid wages of the miners.

New Machinery for B.C.

Many of the leading shippers in the mining district of British Columbia are increasing their plants. New machinery to the value of over half a million dollars has been ordered and will be installed during the next few months in a number of mines in the Rossland and Slocan districts. The Velvet mine at Rossland is putting in new concentrators and stamps that will cost $45,000. At the Cliffe mine in Rossland about $30,000 is to be expended in a thirty-stamp mill to increase the output; $12,000 is being expended by the Spitzee mine at Rossland in compressors and machine drills.

Companies Incorporated.

Detroit & Leamington Oil Co., of Arizona, granted power to do business in Ontario.

Guelph Foundry Co., Limited, Guelph, given power to increase capital stock from $40,000 to $200,000.

Ayton Cordage Co., Limited, Ayton, given power to increase capital stock from $70,000 to $250,000.

Adams Bros. Harness Mfg. Co., Limited, Toronto, Dominion charter, granted power to do business in Ontario.

Hawkesbury Electric Light and Power Co., Limited, Hawkesbury, Dominion charter, granted power to do business in Ontario.

Close Brick Company, Stratford, share capital, $25,000; purpose to manufacture brick and tile. The directors are: J. H. Kenner, J. L. Young and D. H. Farrow, all of Stratford.

Lumen Bearing Company, of New York, given power to manufacture and sell metals, etc., in Ontario, on a share capital of $60,000; N. K. B. Patch, of Toronto, to be the company's attorney.

Keystone Engineering Company, Toronto, share capital, $40,000; purpose to do a general construction business. The directors are: A. W. Kirven, F. B. Johnston and S. Johnston, all of Toronto.

Boileau Reduction Co., Limited, Toronto, share capital, $1,200,000; purpose to mine and mill metals. The directors are: F. Plumb, F. V. Philpott, J. T. Ross, T. S. Collis, and F. W. Baldwin, all of Toronto.

Dain Manufacturing Company, of Iowa, given power to manufacture and sell agricultural implements, etc., in Ontario, on a share capital of $40,000. F. R. Shantz, of Preston, to be the company's attorney.

Galt Building Construction and Real Estate Co., Limited, Galt, share capital $40,000; purpose to do building and construction. The directors are: F. E. Brown, T. A. Norris and W. C. Marriott, all of Galt.

John Hillock & Company, Toronto, share capital, $40,000; purpose to carry on a lumbering business. The directors are: F. Hillock, J. S. Hillock, M. C. Hillock, J. F. Hillock and C. W. Hillock, all of Toronto.

Clark-Demill, Hespeler, share capital, $100,000; purpose to manufacture machinery and tools. The directors are: G. D. Forbes, Z. A. Hall, W. H. Weaver, A. Oches, J. R. Phin and C. M. Shultz, all of Hespeler.

Thomas Lawson & Sons, Ottawa, share capital, $50,000; purpose to act as electroplaters, machinists, etc. The directors are: T. Lawson, C. T. Lawson, A. T. Lawson, R. M. Lawson and J. Lawson, all of Ottawa.

General Leather Goods Co., Limited, Toronto, share capital, $40,000; purpose to manufacture and sell leather goods. The directors are: Joseph Kilgour, A. Pardoe, jr., R. H. Cameron and M. A. Cameron, all of Toronto.

Canada Glue Co., Toronto, share capital $100,000, purpose to manufacture glue and similar materials. The directors are: P. Kreismann, O. C. Butz, F. Rudolph, A. Wintermute, and C. C. Johnston, all of Chicago.

Crushed Stone, Limited, Toronto, share capital, $40,000; purpose to manufacture and sell building and crushed stone. The directors are: W. H. Essery, W. H. Adamson, G. W. Essery and F. H. Adamson, all of Toronto.

Northern Development Co., Limited, Montreal, share capital $40,000, purpose to carry on mining and milling metals. The directors are: C. H. Archer, J. L. Perron, L. Beauchant, J. L. Perrault, and M. E. Braise, all of Montreal.

The E. Cavanagh Co., Limited, Montreal, share capital $100,000, purpose to carry on a general hardware business. The directors are: V. A. Pilon, H. A. Pilon, W. J. Henderson, A. W. G. MacAllister, and A. C. Calder, all of Montreal.

Davies, Limited, Montreal (share capital, $500,000), propose to do a general meat packing and general merchandise business. The directors are: R. D. McGibbon, Douglas Armour, K. J. Beardwood, and L. L. Legault, all of Montreal.

W. J. McGuire & Co., Montreal, share capital, $50,000; purpose to do a manufacturing and plumbing business. The directors are: W. J. McGuire and G. F. McGuire, of Toronto; and R. J. McCauley, W. L. Horn, and H. C. Stone, of Montreal.

Canadian Appraisal Company, Montreal. share capital, $50,000; purpose to appraise industrial plants, do construction work, etc. The directors are: F. Paul, W. M. Doull, P. C. Ryan, L. Guest, H. Seymour and E. Dowson, all of Montreal.

Meaford Wheelbarrow Co., Limited, Meaford, share capital $90,000, purpose to carry on the business of Jas. H. Cleland. The directors are: J. H. Cleland, J. Cleland, H. R. Cleland, and Wm. Butchart, of Meaford, and A. Gibb, of Montreal.

Canadian Fairbanks Co., Limited, Montreal, share capital $500,000, purpose to acquire and carry on the business of the Fairbanks Co. The directors are: Henry J. Fuller, C. M. Redul, T. A. Pownall, C. A. Duclos, and E. J. Sarle, all of Montreal.

Leamington Light and Heat Co., Limited, Leamington, share capital, $40,000, purpose to supply gas and electric power for lighting. The directors are: W. Stares, E. Stares, W. Snider, all of Leamington; J. M. Reid, of Essex, and J. W. Post, of Chatham.

Lewis Bros., Limited, Montreal, share capital, $1,000,000; purpose to acquire and carry on the wholesale hardware business of Lewis Bros. & Co. The directors are: Fred. O. Lewis, Jas. G. Lewis, Wm. Lewis, C. M. Strange and C. F. Smallpiece, all of Montreal.

Peninsular Tool & Specialty Co., Windsor, share capital $22,000, purpose to manufacture moulders' and masons' tools. The directors are: G. Thompson, W. Thompson, J. E. Wright, W. Wright, W. Misner, and G. W. Lane, all of Windsor, and C. C. Stewart, of Detroit.

Empire Sash and Door Company, Ltd., Winnipeg (share capital, $100,000), purpose to deal in coal, lumber and general construction material. The directors are: W. H. McWilliams, G. R. Crowe, John Love, G. W. Allan, all of Winnipeg, and G. F. Piper, of Mnneapolis, Minn.

Canadian Drawn Steel Co., Limited, Hamilton, share capital, $100,000; purpose to manufacture and deal in iron and steel. The directors are: W. A. McCool and T. G. Stein, of Beaver Falls, Penn.; H. J. Waddie, E. G. Willard, D'Arcy R. C. Martin, all of Hamilton.

Christie Bros. Co., Limited, Winnipeg, share capital $60,000, purpose to deal in stoves, ranges and plumbers' supplies. The directors are: W. J. Christie, J. H. Christie, of Owen Sound; V. A. Harshaw, of Toronto; A. D. Christie, J. A. Christie, and J. E. Atkins, all of Winnipeg.

Canadian Northern Coal and Ore Dock Co., Limited, Toronto, share capital, $500,000; purpose to construct and operate docks and elevators. The directors are: J. S. Lovell, Wm. Bain, R. Gowans, E. M. McNeil, R. Richardson, F. C. Annesley, and R. P. Ormsby, all of Toronto.

The J. T. Thompson Co., Limited, St. Catharines, share capital $50,000, purpose to manufacture tinware, etc. The directors are: J. T. Thompson and J. Thompson, of Hamilton; W. B. Smith, of Port Rowan; H. W. Fairlee, of St. Davids, and A. A. Miller, of Toronto.

North Bay Light, Heat and Power Co., Limited, North Bay, share capital, $50,000; purpose to supply gas and electricity for light, heating and power. The directors are: T. Wallace, J. T. Lovell, Wm. Martin, sr., and Wm. Martin, jr., all of North Bay, and A. F. Leggatt, of Ottawa.

Blind River Light, Heat and Power Company, Blind River, share capital, $40,000; purpose to operate electric power and lighting works. The directors are: D. I. Miller, of S. Ste. Marie, Ont.; F. R. Price and D. S. Pindall, of S. Ste. Marie, Mich.; E. F. Bradley, of Toronto, and G. J. McArthur, of Blind River.

Fountain Condenser Co., Limited, Petrolia, share capital, $40,000; purpose to manufacture and sell steam condensers and devices for chimneys and smoke stacks. The directors are: John C. Fountain, Parkhill; J. Schram, D. S. Robb, of London; J. C. Winters, Mt. Morris, N.Y., and Isaac Greenizine, of Petrolia.

William Muir & Son, Limited, Montreal, share capital, $45,000; purpose to carry on the business of buying, selling and dealing in coal and other fuel. The charter members are: John Ryan, Patrick Joseph Heelan, Patrick Doyle, Robert Clark McMichael, and Francis George Bush, all of Montreal.

Gauthier & Frere, Quebec, share capital, $50,000; purpose to do painting, paper glazing, etc. The charter members are: Joseph Gauthier, Ovide Gauthier, Joseph Edouard Bedard, H. Eudore Gauthier, C. Eugene Gauthier, Raoul O. Gauthier, and Joseph W. Gauthier, all of Quebec.

Monteray Electric and Gas Company, Toronto, share capital, $3,000,000; purpose to carry on business as an electric lighting and power company. The charter members are: William MacKenzie, William Laidlaw, Z. A. Lash, and A. W. MacKenzie, all of Toronto, and Herbert Samuel Holt, of Montreal.

The Modern Tool Room.*

In a great many of our modern machine tool establishments of today we find that the tool room does not receive the care and the attention it should. It ought to receive even more than the regular productive department, since the efficiency of the shop depends greatly upon the product of the tool room. The employes in the tool room are usually termed non-producers, which, without a doubt, is a misnomer, for after we consider what results they bring about, they become the most efficient producers in conjunction with the shop. We have an infinite number of proofs that with their aid, coupled with the ingenuity of the general superintendent, the time on many operations was cut in half. Then feeling satisfied that the time to accomplish a certain job had reached rock bottom, we find to our agreeable surprise that with their help the time was again reduced, demonstrating by this that the toolmaker is the most vital element in the increase of production, and that he is a producer and not a non-producer.

While a general shop workman's efforts cannot usually be made more strenuous, we can nevertheless give him such fixtures that by these same efforts a greater production will ensue: hence the importance of the tool room which is to supply these fixtures.

The tool room (if properly handled) and its products can save more money for a concern than any other department in the shop. The writer can recall operations which formerly required 100 hours to perform, reduced to 33 hours by the use of a simple jig, requiring 25 hours to make; hence a saving of 42 hours on the first lot alone, including the time of the manufacture of the jig. Another example of time saving in the boring of spindles can be cited: The time was reduced from 2 1-2 hours to 14 minutes. This was accomplished by the use of a special drill and a properly equipped lathe.

Since the tool room is a necessity, the first question naturally arises, in what manner can the work done there be most efficiently accomplished? These jigs and special appliances cannot be bought in the open market; they must then be made or designed at the works, and their degree of success depends largely upon the ingenuity of the designer and his familiarity with the work to be accomplished.

It is of the utmost importance that when the tool room foreman deals out his work he does so with the clearest explanation possible, together with all the material and drawings intended for the construction of the work. The drawings should be detailed as much as possible, so as to be clear to the workman. In detailing a drawing, usually more than one man can work on the same job at the same time and the fixture can be brought to completion more hurriedly and with many less doubts and misunderstandings. The detailing of drawings is rather inexpensive, as an inexperienced draftsman can usually do this after the designer finishes composition drawing.

A list of stock screws as well as of the standard parts from stock should accompany every drawing to the tool room. By this system the drawing may be turned over to the stockkeeper that he may pick out the standard parts used in the fixture and deliver them to the tool room. Every tool room, as well as drawing room, should have a sample board of stock screws, pins, washers, nuts, oil cups, etc., suitably numbered so that the drafstman may pick them when designing a jig and indicate them on the drawing. These sample boards are not very costly, and are a great help in designing jigs, or even regular work, as it reduces the tendency to order new stock to a minimum.

It is as futile to attempt to win success with obsolete machinery as biting on granite.

Referring again to the lists accompanying the drawing, it is easily understood that in this manner the tool room foreman is relieved of a great deal of running about in getting the various parts together, as a messenger may easily obtain what is required. With such conditions the tool room foreman may put in his time to better advantage by directing his attention to more important matters, such as to speeds and feeds. It is a well known fact that the speeds and feeds that are being used in our tool rooms to-day are much less than those used in the regular productive department, and which have been found to be both efficient and correct. By relieving the foreman of a great many of these petty details he can exert himself along these lines, undoubtedly producing more satisfactory results.

It frequently happens that there exist better facilities for doing certain classes of work outside of the tool room and much time could be saved by performing the work on the outside. The forman of the tool room should know just where to place such jobs, so as to get them out in the least possible time. For example: A certain piece of work may require one hour to bore in a lathe, while if dispatched to the chucking lathe department it might be done in 15 minutes. There are numerous examples of this cropping out every day where considerable time could be saved by a wide-awake foreman.

Some may form the opinion that systems of this kind, in getting up lists to relieve the tool room foreman, may throw an extra burden on the drawing room by requiring more help: but, gentlemen, since it's a matter of dollars and cents, the question arises: In what manner can the tools be brought to completion with the least expenditure of funds?

With all the possible data at his fingers' ends, it is certainly evident that a little time expended by the draftsman in systematizing will mean a great deal more time saved by the toolmaker, for me must also consider the toolmakers, as a rule, are among the best paid men on the payroll.

How often do we find, after a jig is put in operation for the first time, that some adjusting in one form or another is necessary. This emphasizes all the more the necessity of having the jigs thoroughly tested before leaving the tool room, by performing the actual operation the tool is intended for and all errors and inaccuracies eliminated then, so that when the fixture is put to final work, we have the assurance that it is correct.

If the tools are not thoroughly tested before leaving the tool room the inaccuracies, as they manifest themselves, will mean the loss of much time spent in the tearing down and rigging up of the machines to make them correct. It is also likely to cause a delay in regular routine work. The jig must then under-

* A paper read before the Cincinnati Metal Trades Association.

go a hurried renovation, which is not very conducive to the most accurate results. All unnecessary work should be avoided on jigs. This is very likely to occur, as toolmakers often take pride in their work and are apt to spend too much time in unnecessary polish and spotting. Since these fixtures do not leave the shop, they have no reputation to sustain, hence accuracy alone need be paramount.

In a small shop the tool storage department and the tool manufacturing department usually work very well combined in one, but in a larger establishment a greater efficiency in the running of the plant will result by having them independent. The reasons are self-evident, and a specialty along these lines has the same points in its favor as a specialty in any other line of work.

A shop with a number of tools and fixtures should have a fixture storeroom, where jigs of every department could be stored and a record of same kept by card index, so that a change in the management of that department would cause no confusion. After their return from their actual operations, they could then be thoroughly inspected. If this is not attended to they are very apt to run down and become inefficient. If after their inspection repairs are found necessary these ought to be made before being stored, and not wait until needed again, as this would cause delay. Jigs upon their return should be dispatched to their proper store places as speedily as possible, and not allowed to accumulate. Cutters, drills, reamers and all edge tools ought to be sharpened before being stored.

In the case of a fixture requiring a number of tools, such as drills, reamers, boring bars, etc., it is a good plan to keep them together, in a suitable receptacle of some kind, and given out with a fixture. This saves time in looking up each piece separately, also preventing delay in regular routine work.

Special attention should be given to arbors. If, for example, an arbor is returned untrue and this is not corrected, it is evident that each piece made thereafter will come off untrue, and possibly cause much extra work and delay in the assembling department.

Considering the time, ingenuity and money that are expended in getting up these special fixtures in a shop, it is certainly evident that should they be destroyed by fire a great loss would result. For this reason a record of same in the way of drawings should be kept in a fireproof vault. If this is not done, it is easily understood that the very elements which entered into the reducing of the machine to a paying basis would be quite difficult to duplicate.

All adjustable reamers of the entire establishment ought to be adjusted by one man. If this is left to the different workmen using them it is certain that quite a variation of holes, intended for the same size holes, would soon exist and continual difficulty be experienced.

SERIES OF LECTURES.

The authorities of McGill University, Montreal, are aware of the importance of keeping their students in the science courses informed upon the latest advances in the manufacturing world. For that purpose the leading specialists in different branches are invited from time to time to address the students.

Mr. H. A. Burson, B.A. Sc., chief electrical engineer of Allis-Chalmers-Bullock, Limited, has just completed a series of addresses upon induction motors, of which the company makes a specialty.

LABOR TROUBLES.

"What was the cause of the fight between the members of the union that is out on strike?"

"Well, one crowd fixed up a dummy of the employer, stuffed it with paper, hung it to a telegraph pole, and burned it."

"And the others objected to this proceeding?"

"Yes."

"An encouraging sign. When laboring men resent the offering of insults to their——"

"Oh, they didn't care so much about the employer. What they kicked about was that the other fellows didn't hire a member of the paperhangers' union to hang the effigy."—Chicago Tribune.

He Got It.

A manufacturer hired a boy. For months the only noticeable thing about the boy was that he never took his eyes off the machine he was running. One day the manufacturer looked down from his work to see the boy standing beside his desk.

"What do you want?" he asked.

"Want me pay raised," said the boy.

"What are you getting?"

"T'ree dollars a week."

"Well, how much do you think you are worth?"

"I t'ink I am worth $4, and I've been t'inking so for t'ree weeks, but I've been so blame busy I haven't had time to speak to you about it."

The boy got his raise. He deserved it, just as every man deserves it who is too busy about his employer's work to worry about his next week's envelope.

LARGEST GAS GENERATOR UNIT IN THE WORLD.

WHAT is believed to be the largest single unit illuminating gas generator in the world is producing 3,000,000 cubic feet of gas every 20 hours in Oakland, California.

The scarcity of coal and the abundance of oil has driven every coal-gas plant but one in the State to the use of oil, and the former high price of gas has dropped to that prevailing in Eastern States. The mammoth gas-from-oil generator is described in the Purifier.

The set comprises two steel shells, cylindrical in shape, sixteen feet in diameter and twenty-eight feet high, being used as a generator while the other is a superheater. These shells are connected at the top by a flue box, so arranged as to provide the largest possible opening for the flow of gas. Unlike other oil gas generators, this one contains no arches, and the oil is treated by heat radiated from checker brick and the walls of the lining, instead of by direct contact. The bottom portion of the generator is an open combustion chamber, drawn in at the top in a manner similar to the dome of a cupola, and while the inside diameter of the generator is eleven feet four inches, the neck piece at the top of the combustion chamber is drawn in to six feet. On the top of the corbel work, which forms the dome of the combustion chamber, there is a shelf nearly three feet wide encircling the generator, and on this shelf checker brick are laid to a point reaching the bottom of the flue connecting the two shells. The superheat is filled with checker brick, laid in the ordinary manner with vertical flues of large area.

The generator is connected by two 33-inch outlet pipes to a wash box provided with a seal and acting as a hydraulic main, and from this box the gas passes through a scrubber 12 feet by 30 feet, and two scrubbers 10 feet by 30 feet.

This machine, which produces 150,000 cubic feet of gas per hour, is handled by the labor of one man. There is no shovelling of coal, and the most difficult work the gas maker does is to open and close a valve.—Popular Mechanic.

THE LEVY, WESTON & McLEAN MACHINERY CO., LIMITED

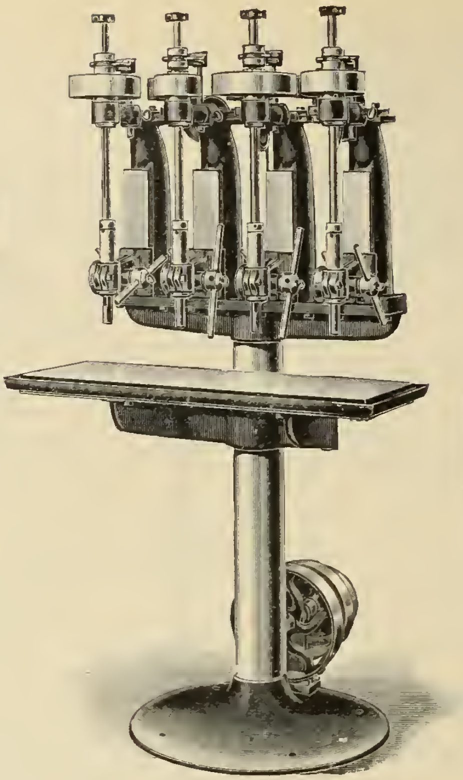
TORONTO

Offer the following NEW and REFITTED MACHINERY for prompt shipment:

20″x10′ Engine Lathe, new.
16″ Back Geared Crank Shaper, new.
1″, 1½″ and 2″ Acme Bolt Cutters, new.
21″ Wheel and Lever Drill Press, new.
40 h.p. Hor. Return Tubular Boiler, new.
11″x10″ Centre Line Clipper Engine, new.
Band Saws, Buzz Planers, Saw Tables, Planers and Matchers, manufactured by Standard Makers, new.

Bargains in Refitted Machinery

One Double Cope Tenoning Machine.
One Single Cope Tenoning Machine.
Two Self Feed Rip Saw Tables.
26″x6″ Revolving Bed Double Surface Planer.
26″x5″ Whitney Planer, fine order.
70″ Sturtevant Planing Mill Exhaust Fan, practically new.
1000′ Heater with 50″ Sturtevant Fan.
8 h.p. Gould, Shapley & Muir Gasoline Engine, practically new.
10, 12 and 25 h.p. Portable Engines and Boilers, on wheels.
One Lincoln Plain Milling Machine.



SENSITIVE DRILLS

With or Without Power Feed

With one to ten spindles. Good line of Bench Drills, and Planer Chucks.

FRANCIS REED CO.

43 HAMMOND STREET, WORCESTER, MASS.

A MODERATE PRICED

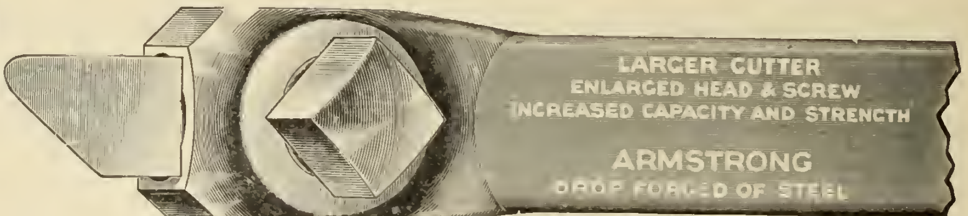
HIGH GRADE GRINDER

Will grind any tool in the shop.
Has six inch bearing.
Is very rigid and strong.
Height from floor to spindle forty and one-quarter inches (40¼″).
Is a beautiful tool.
Price only $21.50.

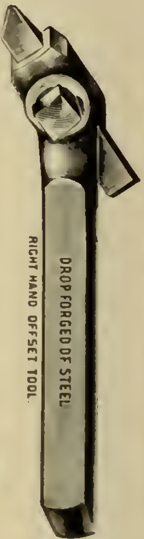
D. McKenzie & Co., London, Can.

ARMSTRONG TOOL HOLDERS

ARE IN A CLASS BY THEMSELVES.



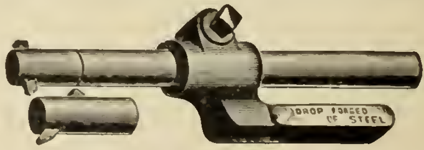
Patented February 28, 1893, and patent applied for



GOLD MEDAL HIGHEST AWARD at Saint Louis for Economy, Convenience, Originality and General Excellence.

Patented May 28, 1901

Write for Catalog.



Boring Tool. Patented March 12, 1895.

Armstrong Bros. Tool Co., "THE TOOL HOLDER PEOPLE" **669 Austin Ave., Chicago, U.S.A.**

FOREIGN AGENTS Chas. Churchill & Co., Ltd., London, Manchester, Birmingham, Glasgow. Schuchardt & Schutte, Berlin, Brussels, Vienna, St. Petersburg. G. Koeppen & Co., Moscow. C. S. Christensen, Christiania. Palmer & Co., Wellington, New Zealand. Societe de Produits Metallurgique, Nancy, France. J. W. Smith, City of Mexico.

IMITATIONS ARE UNSATISFACTORY—INFRINGEMENTS ARE UNLAWFUL.

MACHINERY BUYERS' DIRECTORY.

Readers of CANADIAN MACHINERY are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principal firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

Abrasive Materials.

The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
H. W. Petrie, Toronto.

Arc Lamps.

Canadian General Electric Co., Toronto.
The United Electric Co., Toronto.

Air Brakes.

Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Barrels, Tumbling.

The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.

Niles-Bement-Pond Co., New York.

Belting, Leather.

The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Belting Supplies.

H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.

Niles-Bement-Pond Co., New York.

Blowers.

H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Boilers.

Goldie & McCulloch Co., Galt.
Levy, Weston & McLean, Machine Co., Toronto.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.

Boiler Compounds.

Canada Chemical Mfg. Co., London, Ont.

Bolt Cutters.

National Machinery Co., Tiffin, Ohio.

Bolt and Nut Machinery.

National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Books, Mechanical.

The MacLean Pub. Co., Ltd., Toronto.

Boring and Drilling Machines.

B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.

Boring and Turning Mills.

American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Bulldozers.

National Machinery Co., Tiffin, Ohio.

Cabinets, Tool.

Armstrong Bros. Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Rice Lewis & Son, Toronto.

Centring Machines.

Pratt & Whitney Co., Hartford, Conn.

Centres, Planer.

Pratt & Whitney Co., Hartford, Conn.

Chucks, Drill and Lathe.

Ker & Goodwin, Brantford.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Circuit Breakers.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Chucking Machines.

American Tool Works Co., Cincinnati.
H. W. Petrie, Toronto.
Potter & Johnston Mach. Co., Pawtucket, R.I.

Compressors, Air.

Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Controllers and Starters, Electric Motor.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock Co., Montreal.

Cotton Belting.

Sadler & Haworth, Montreal.

Cupola Blowers.

Sheldon & Sheldon, Galt, Ont.

Cutters, Milling.

Becker, Brainard Milling Machine Co., Hyde Park, Mass.

Cutting-off Machines.

Hurlbut-Rogers Machine Co., South Sudbury, Mass.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Tools.

Armstrong Bros. Tool Co., Chicago.
H. W. Petrie, Toronto.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.

Dies, Opening.

Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.

The Globe Machine and Stamping Co., Cleveland, Ohio.

Dies, Threading.

Pratt & Whitney Co., Hartford, Conn.

Drills, Bench.

B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.

Drills, Centre.

Pratt & Whitney Co., Hartford, Conn.

Drills, High Speed.

Wm. Abbott, Montreal.

Drills, Horizontal.

B. F. Barnes Co., Rockford, Ill.

Drills, Ratchet.

Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler.

American Tool Works Co., Cincinnati.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
H. W. Petrie, Toronto.

Drilling Machines, Multiple Spindle.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Bickford Drill & Tool Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Drilling Machines, Pneumatic

Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Niles-Bement-Pond Co., New York.

Drilling Machines, Radial.

American Tool Works Co., Cincinnati.
Bickford Tool & Drill Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Drilling Machines, Upright.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Drop Forging Dies.

The Globe Machine and Stamping Co., Cleveland, Ohio.

Drying Apparatus of all Kinds.

Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dust Separators.

Sheldon & Sheldon, Galt, Ont.

Dynamos.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London, Ont.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
United Electric Co., Toronto.
Volta Electric Repair works, Toronto.

Electrical Supplies.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London, Ont.
Packard Electric Co., St. Catharines.
The United Electric Co., Toronto.
Volta Electric Repair Works, Toronto.

Electrically Driven Tools and Machinery.

Allis-Chalmers-Bullock, Montreal.
American Tool Works Co., Cincinnati.
H. W. Petrie, Toronto.

Electrical Repairs.

Volta Electric Repair Works, Toronto.

Emery Wheel Dressers.

The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.

Engineers' Supplies.

Levy, Weston & McLean Machinery Co., Toronto.

Engines, Gas and Gasoline.

The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Engines, Steam.

The Goldie & McCulloch Co., Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Exhaust Heads.

Sheldon & Sheldon, Galt, Ont.

Expanded Metal.

Expanded Metal and Fireproofing Co., Toronto

Fans, Electric.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust.

Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Feed Mills.

S. Vessot & Co., Toronto.

Files.

G. & H. Barnett Co., Philadelphia.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.

Forges.

Allis-Chalmers-Bullock, Montreal.
Boynton & Plummer, Worcester, Mass.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.

Forgings, Drop.

The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.

Forging Machinery.

National Machinery Co., Tiffin, Ohio.

Gang Drills.

B. F. Barnes Co., Rockford, Ill.

Gauges, Standard.

Pratt & Whitney Co., Hartford, Conn.

Gear Cutting Machinery.

Becker - Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Generators.

Canadian General Electric Co., Toronto.
H. W. Petrie, Toronto.
The United Electric Co., Toronto.

Grinders, Centre.

Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Cincinnati Milling Mach. Co., Cincinnati.
Pratt & Whitney Co., Hartford, Conn.

Grinders, Tool.

Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
H. W. Petrie, Toronto.

Grinding and Polishing Machines.

The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Hammers, Pneumatic.

Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Niles-Bement-Pond Co., New York.

Heating Apparatus.

Sheldon & Sheldon, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., High Park, Mass.

Hoisting and Conveying Machinery.

Niles-Bement-Pond Co., New York.
The Smart- Turner Mach. Co., Hamilton.

Hoists, Pneumatic.

Canadian Rand Drill Co., Montreal.

Injectors.
The Canadian Fairbanks Co., Montreal.
Penberthy Injector Co., Windsor Ont.
Rice Lewis & Son, Toronto.

Iron Tools.
Levy, Weston & McLean Machinery Co. Toronto.
H. W. Petrie, Toronto.

Lace Leather.
Sadler & Haworth, Montreal.

Lathe Dogs.
Armstrong Bros., Chicago.
Pratt & Whitney Co., Hartford, Conn.

Lathes.
American Tool Work Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
R. McDougall & Co., Galt, Ont
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Sebastian Lathe Co., Cincinnati, O.

Lathes, Automatic, Screw-Threading.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.
Pratt & Whitney Co., Hartford, Conn.

Leather Belt Dressing.
Sadler & Haworth, Montreal.

Leather Belting.
Sadler & Haworth, Montreal.

Leather Belting, Waterproofed.
Sadler & Haworth, Montreal.

Lumber Dry Kilns.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.

Machinery Dealers.
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
Machinery Exchange, Montreal
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Williams & Wilson, Montreal.
C. C. Wormer Mach. Co., Windsor.

Machinists' Small Tools.
Armstrong Bros., Chicago.
Pratt & Whitney Co., Hartford, Conn.
Rice Lewis & Son, Montreal.

Mechanical Draft.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Metallic Lacing.
Sadler & Haworth, Montreal.

Milling Attachments.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Niles-Bement-Pond Co., New York,
Pratt & Whitney Hartford, Conn.

Milling Machines, Horizontal.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Niles-Bement-Pond Co., New York.
Pratt & Whitney, Hartford, Conn.

Milling Machines, Plain.
American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Cincinnati Milling Machine Co., Cincinnati
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Universal.
American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Cincinnati Milling Machine Co., Cincinnati
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Milling Machines, Vertical.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Niles-Bement-Pond Co., New York.

Milling Tools.
Wm. Abbott, Montreal.

Mining Machinery.
Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.

Motors, Electric.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The United Electric Co., Toronto.

Nut Tappers.
National Machinery Co., Tiffin, Ohio.

Oatmeal Mill Machinery.
The Goldie & McCulloch Co., Galt.

Pipe Cutting and Threading Machines.
Niles-Bement-Pond Co., New York.
Oster Mfg. Co., Cleveland, O.

Planers.
American Tool Works, Cincinnati.
Cincinnati Planer Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Co., Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Planing Mill Fans.
Sheldon & Sheldon, Galt Ont.

Pulleys.
The Dodge Mfg. Co., Toronto.
The Canadian Fairbanks Co., Montreal.
The Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Pumps.
Canada Foundry Co., Toronto.
The Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Punches and Dies.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.

Punches, Power.
Niles-Bement-Pond Co., New York.

Presses, Hydraulic.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niles-Bement-Pond Co., New York.

Reamers.
Wm. Abbott, Montreal.
Pratt & Whitney Co., Hartford, Conn.

Riveters, Hydraulic.
Niles-Bement-Pond Co., New York

Riveters, Pneumatic.
Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.
Niles-Bement-Pond Co., New York.

Rubber Belting.
Sadler & Haworth, Montreal.

Sawing Machines, Metal.
Niles-Bement-Pond Co., New York.

Saw Mill Machinery.
Goldie & McCulloch Co., Galt.
Levy, Weston & McLean Machine Co., Toronto.
H. W. Petrie, Toronto.
Waterous Engine Works, Brantford.

Second-hand Machinery.
The Canadian Fairbanks Co., Montreal.
Goldie & McCulloch Co., Galt.
Levy, Weston & McLean Machine Co., Toronto.
Machinery Exchange, Montreal.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.
C. C. Wormer Mach. Co., Windsor.

Screw Machines, Automatic.
Pratt & Whitney Co., Hartford, Conn.

Screw Machines, Hand.
Potter & Johnston Mach. Co., Pawtucket, R.I.
Pratt & Whitney Co., Hartford, Conn.

Screw Plates.
Oster Mfg. Co., Cincinnati, O.

Shapers.
American Tool Works Co., Cincinnati.
Boynton & Plummer, Worcester, Mass
Cincinnati Shaper Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machine Co., Toronto.
Niles-Bement-Pond Co., New York
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn
John Steptoe Shaper Co., Cincinnati, O.

Shears, Power.
Niles-Bement-Pond Co., New York.

Sheet Metal Goods.
The Globe Machine and Stamping Co., Cleveland, Ohio.

Slotters.
Niles-Bement-Pond Co., New York.

Special Machinery.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Special Machines and Tools.
Pratt & Whitney, Hartford, Conn.

Special Manufacturing.
The Globe Machine and Stamping Co. Cleveland, Ohio.

Speed Changing Countershafts.
The Dodge Mfg. Co.,Toronto.
The Canadian Fairbanks Co., Montreal.

Spike Machines.
National Machinery Co., Tiffin, O.
The Smart-Turner Mach. Co., Hamilton.

Steam Separators.
Sheldon & Sheldon, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.

Steam Traps.
Sheldon & Sheldon, Galt, Ont.

Stampings, Sheet Metal.
Globe Machine and Stamping Co., Cleveland, Ohio.

Steel, High Speed.
Wm. Abbott, Montreal.

Steel Pressure Blowers.
Sheldon & Sheldon, Galt, Ont.

Stitched Cotton Duck Belting.
"Gardy," Sadler & Haworth, Montreal.

Switch Boards.
Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co. of Toronto.
The United Electric Co., Toronto.
Volta Electrical Repair Works, Toronto.

Taps and Dies.
Wm. Abbott, Montreal.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rice Lewis & Son, Toronto.

Tapping Machines and Attachments.
American Tool Works Co., Cincinnati.
Bickford Drill & Tool Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney, Cincinnati, O.

Tool Holders.
Armstrong Bros. Tool Co., Chicago.
H. W. Petrie, Toronto.

Tool Steel.
Wm. Abbott, Montreal.

Transmission Machinery.
The Dodge Mfg., Toronto.
The Canadian Fairbanks Co., Montreal
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Transmission Supplies.
The Goldie & McCulloch Co., Galt.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.

Turret Machines.
American Tool Works Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
Levy, Weston & McLean Machine Co., Toronto.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Upsetting and Mending Machinery.
National Machinery Co., Tiffin, O.

Vaults.
The Goldie & McCulloch Co., Galt.

Valves, Back Pressure.
Sheldon & Sheldon, Galt.

Vises, Planer and Shaper.
Cincinnati Planer Co., Cincinnati.

Ventilating Apparatus.
Sheldon & Sheldon, Galt, Ont.

Washer Machines.
National Machinery Co., Tiffin, Ohio.

Window Wire Guards.
B. Greening Wire Co., Hamilton, Ont.

Wire Chains.
The B. Greening Wire Co., Hamilton.

Wire Cloth and Perforated Metals.
B. Greening Wire Co, Hamilton, Ont.

Wire Guards and Railings.
B. Greening Wire Co., Hamilton, Ont.

Wire Nail Machinery.
National Machinery Co., Tiffin, Ohio

Wire Rope.
B. Greening Wire Co., Hamilton, Ont.

Wood-working Machinery.
The Canadian Fairbanks Co., Montreal.
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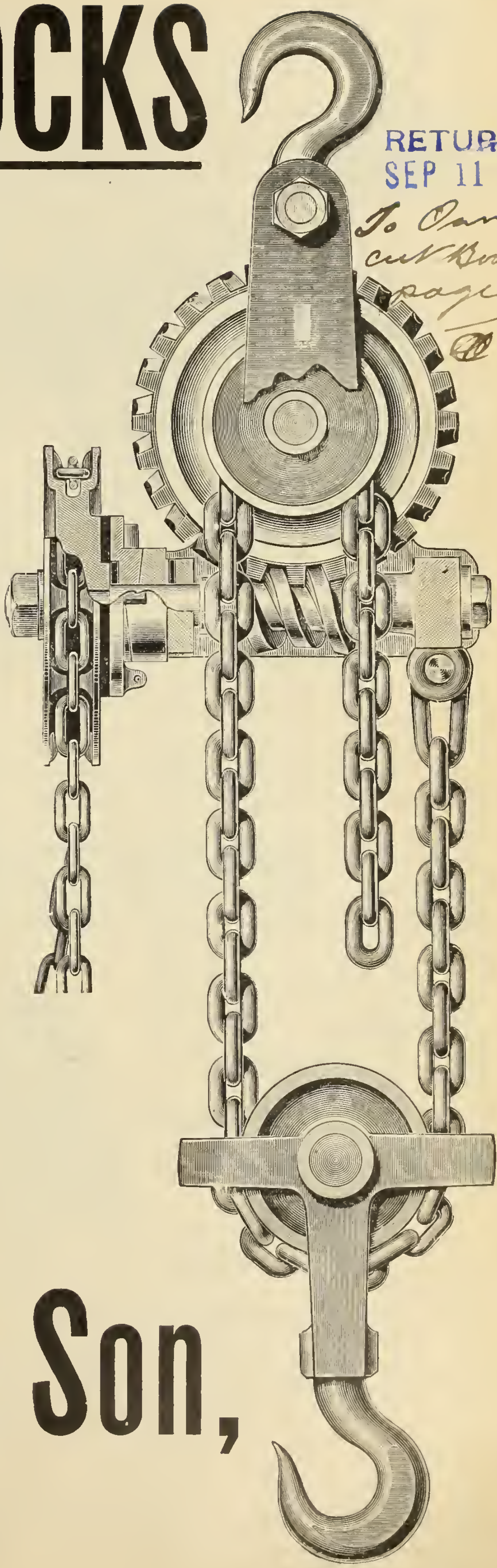
Levy, Weston & McLean Machine Co. Toronto.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

ALPHABETICAL INDEX.

CONTENTS.

HYPER ACME CHAIN BLOCKS



The friction in this block is automatically cut off as the load rises, and consequently only the load being raised need be reckoned on, thereby reducing the power required by more than one-half.

Each block is tested to 50 per cent. above the nominal power it is sold for.

One man can lift any weight up to 10 tons with far greater ease and very much quicker than with the ordinary pulley block.

Sizes in stock, with 12 and 15 foot lift :
½, 1, 1½, 2, 3, 4, 5, 10 ton.

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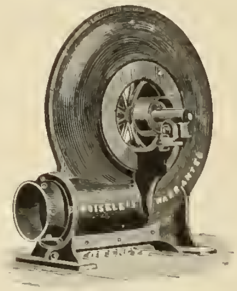

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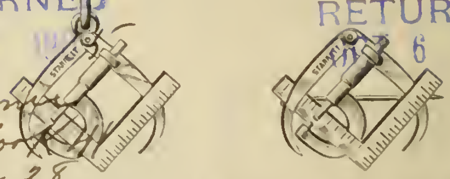

To Owner
Cut Book
page 28

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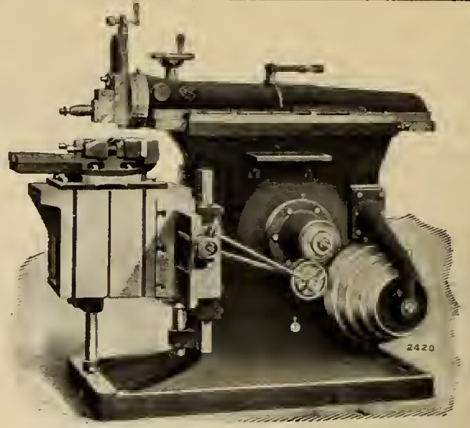

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Planers

a-439. 15" x 12" x 3' with angle plate, V. block, centers and chuck.
a-426. 20" x 16" x 3' New Haven.
a-433. 20" x 20" x 5' Newton Machine Tool Co.
a-435. 21" x 18" x 4' 7".
a-442. 22" x 22" x 5' A. M. Powell & Co.
a-427. 24" x 24" x 5' New Haven.
a-429. 28" x 28" x 8' " "
a-444. 30" x 30" x 6' Beardsley, K. & C.
a-443. 72" x 52" x 20' Betts Machine Co.
a-438. 48" x 48" x 12' three heads, L. W. Pond Mach. Co.
a-437. 42" x 36" x 11' 6" Wm. Sellers & Co. spiral drive.
a-81. 68" x 60" x 25' two heads, New Haven.
No. 213. 67" x 48" x 23' two heads, New Haven.
No. 65. 40" x 36" x 25' two heads, New Haven.
No. 108. 40" x 36" x 18' two heads, New Haven.
72" x 72" x 36' New Haven, two heads, bed in three sections, can be changed to plane 20'.

Bench Drills

a-366. 20" Hand Wheel and Screw feed, spindle $1\frac{1}{4}$", travel 8".
a-324. 2-spindle on frame, 15" centers.
a-321. Sensitive, 26" high, 1 5-16" travel of spindle.
a-323. 10" Dwight Slate Sensitive to bolt against bench, $2\frac{3}{4}$" rack feed, table adj. on column.

Post Drills

a-342. 16" Post Drill.
a-351. Blacksmith Hand Drill.
a-352. 14" Blacksmith Drill, Champion.
a-374. 18" Blacksmith power feed, Champion.

Drills

a-315. Overhanging, back geared, spindle 1 11-16" screw feed by hand.
a-319. Swinging arm, 3' 3" long, jointed for bolting to post.
a-362. 12" three-spindle on column, spindles $\frac{3}{4}$", bearings $6\frac{1}{2}$", table 15 x 10, hand and foot lever feed.
a-367. 9" three-spindle, Gang, Cross & Speirs Sensitive on column with chuck.
a-355. Dallett Portable, No. 4 taper, rope drive.
a-365. Assembling and Drilling Machine with adj. revolving table, nicely suited for special work.
a-380. 20" Plain Sliding Head, wheel feed, table 24" x 22", raises by rack and pinion, head adj. 31", spindle 9" travel.
a-383. 26" stationary head, back gear, spindle 1 15-16", travel 10", table raises and lowers by screwing around column.
a-341. 20" round base, lever feed, Barnes.
a-302. 32" S. H. B. G. P. F. Q. R. Auto Stop, Cincinnati M. T. Co.
a-322. 36" S. H. B. G. P. F. Q. R. Snyder.

Punches, Shears and Presses

a-540. Alligator Shear, blades 12" long, geared 13 to 95, balance wheel 60" diameter.
a-519. No. 6 Long and Allstatter, $4\frac{1}{4}$" Throat, single end capacity $\frac{1}{2}$" in $\frac{1}{2}$".
a-528. No. 7 Long & Allstatter, double machine, throats, $3\frac{3}{4}$" and 4" capacity, $\frac{3}{8}$" in $\frac{3}{8}$".
a-532½. No. 1 Lightning Hand Punch, capacity $\frac{1}{4}$" in $\frac{1}{4}$", $1\frac{1}{2}$" throat.
a-521. No. 2 Buffalo Hand Punch and Shear, 7-16 x 2 flat, $\frac{1}{4}$" in $\frac{1}{4}$", $\frac{3}{4}$" round.
a-520. $2\frac{7}{8}$" throat, hand and power, Punch, geared 7 to 1, stroke 11-16".
a- 24. Hand Power Shear, geared 12 to 64, 48" hand wheel, cut 104" long.
a-534. 6" throat, Punch, stroke $1\frac{1}{4}$", balance wheel 32 x $5\frac{1}{4}$".
a-525. Double Standard Punch, dis. between uprights 14", geared 20 to 50, fly wheel 21" diameter, stroke $1\frac{3}{8}$".
a-557. No. 2 Toledo Inclinable Back (Plain).
a-559. No. 3 Stiles Plain Solid Back (E. W. Bliss Co.)
a 574. 4" throat, geared Power Press for Bench, geared 18 to 106, stroke $1\frac{1}{4}$", die space $4\frac{1}{2}$" x 8".
a-563. 14" throat Foot Press, base 25" x 11", stroke 5".
a-556. Bicycle Cup Press, 11" from base to end of spindle at highest point, 4" from centre of screw to back.
a-559½. Double Column. Sheridan, Geared Press, stroke 3 3-16", adj. of ram 6" for cutting paper forms, etc.

Screw Machines

a-282. $\frac{3}{8}$" through wire feed apparatus. double cut-off, auto., rev. turret, pan and pump, Garvin.
a-289. Three $\frac{3}{8}$" Cleveland Automatic Screw Machines.
a-290. $\frac{3}{8}$" Cleveland Automatic Screw Machine.
a-272. Two 2" Cleveland Automatic Screw Machines with Reeves Variable Speed Countershafts.

Turret Lathes

a-276. 12" x 3' 8" bed, $\frac{3}{4}$" hollow spindle.
a-281. 13" x 5' bed, $\frac{3}{4}$" hollow spindle with chuck.
a-293. 16" x 5' bed, with automatic chuck, Windsor Mach. Co.
a-287. 16" x 4' 6" bed, $1\frac{1}{4}$ in. hollow spindle, W. & S.
a-299. 18" x 6' bed, 15-16" hollow spindle, 12" two-jaw Box Body Chuck, Hendey.
a-294. 15" x 4' 6" bed, friction geared head, auto. chuck, capacity $1\frac{1}{4}$", Garvin Machine Co.

Miscellaneous Bicycle Machinery

a-596. Chain Stud Making Machine, might be rebuilt for special work.
a-612. 10" x 3' Single Head Ball Case Machine, 9-16" H. S. revolving head with taper hole $3\frac{1}{2}$", 3-jaw Universal chuck, head swivels and adj. lever and screw feed, could be nicely adapted for special purposes.
a-618. Frame Assembling Machine with revolving table, drill head adj. to any point, Pratt & Whitney, might be adapted for special purposes.
a-617. Double Pipe Brazing Forge.
a-611. Fox Brazing Forge.
a-622. Ten 4" Filing Vises, swiveling base, rev. jaws, mounted on column, can be used on bench.
a-830. Roller Tube Cutter, capacity 2", geared spindle, cuts any length.
a-839. Fox Wheel Truing Machine for 28" wheels.
a-848. Spoke Threading Machine, 3" travel. adj. $2\frac{1}{2}$".
a-860. Spoke Threading Machine, travel of slide $\frac{3}{4}$", adj. $\frac{1}{2}$", geared feed.
a-824. No. 4 Fox Multiple Tube Cutter, capacity up to 2", any Length.

Miscellaneous

a-819. Die Chamfering Machine with blank holder and one chuck, Hartford Machine Screw Co.
a-885. No. 1 Giant Keyseater, 10" stroke, Mitts & Merrill.
a-804. Rotary Screw Slotter, Garvin Machine Co.
a-296. Screw Slotter, rev. head, adj. to and from screw, Garvin.
a-849. 8' Boiler Shop Rolls, $\frac{1}{4}$" capacity, for hand and power.
a-829. 36" Gould & Eberhardt Semi-Automatic Gear Cutter.
a-831. 4" Cutting Off Machine, accelerated speed. Hurlbut & R.
a-840. Boiler Plate Planer, capacity 14' 6", Wm. Sellers & Co.
a-871. 9" Bement Slotter with swiveling table.
a-884. 44" Car Wheel Borer with 36" Horton, 3-jaw universal chuck.
a-894. Set Rolls 22" between housings, double geared, operated by clutch.
a-860. 60" Niles Single Head Boring Mill, with pulley turning attachment.
a-851½. $\frac{1}{8}$" Adt. Automatic Wire Straightening and Cutting-Off Machine, 16" and shorter.
a-817. Horizontal Keyseater, two rams, screw feed, movement automatic, powerful machine, F. C. Burton & Co.
a-836½ Dayton Swaging Machine, capacity $\frac{3}{4}$" for tubing only
a-837. Goodyear Swaging Machine, spindle $4\frac{3}{8}$" diameter, cap. $4\frac{1}{2}$" long.
a-859. Garvin Horizontal Screw Slotter, capacity up to $\frac{3}{8}$".
a-895. Broaching Machine, $1\frac{3}{4}$" screw, 33" long, threaded 19", clutch pulley, automatic trip.
a-802. Elmore Hand Rock Drill for mining experimental purposes.
a-825. Crank Turning Machine. capacity 7" through, if crank is not over $3\frac{1}{2}$" diameter rough, Vogel Pattern.
a-814 2" Pratt & Whitney Cutting-Off Machine.
a-823. No. 1 Garvin Horizontal Tapping Machine, capacity up to 3-16"
a-842 Power Marking Machine, $1\frac{3}{4}$" plunger, vertical travel $\frac{3}{4}$" mounted on legs, work placed in slot over plunger, balance wheel 26" x 3".
a-811 Wood Tumbling Barrel, 24" at top, 30" at bottom, 30" deep.
a-827. Boring Bar, wrought iron, 3 7-16" diam., 12' 6" long, screw feed with a number of spiders.
a-854½. Square Planer Chuck, jaws $20\frac{1}{2}$" long, 3 11-16" deep, open $11\frac{3}{4}$".
a-865. Crane for 8 x 8 post, 11' 6" arm with traveler.
a-893. Crane with cast iron column, 15, high, 5" diam., arm 9' 6" with traveler
No. 1 Root Cupola Blower.
No. 11 Buffalo Pressure Blower
30" Sturtevant Shaving Blower
36" Hyatt & Smith Ventilating Fan with Motor Attached.
60" Sturtevant Fan, Engine Attached.
8 ton Yale & Towne Chain Hoist.
$1\frac{1}{2}$ ton Facile Chain Hoist.
18" three-jaw Combination Chuck.
24" three-jaw Combination Chuck.
36" four-jaw Combination Chuck.
30" four-jaw Independent Chuck.

Carriage Shop Equipment

40 lb. Bradley Helve Hammer.
Foot Power Hammer, Hitchcock.
20" round base, Lever Drill, Barnes.
16" Post Drill.
Blacksmith Hand Drill, Pratt & Whitney.
Hub Boring Machine, Moyer.
Geared Punch Press, Hitchcock.
No. 3 Double End Emery Grinder, Detroit.
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Tire Bender, hand and power
Tire Truing Machine
Power Tire Bolter.
Hand Tire Bolter.

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7" x 12" Rice Automatic Horizontal.
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Tenoner, cut-off attachment, Smith.
Floor Bolting Machine, Sherman.
Horizontal Boring Machine, Bentel & M.
26" Automatic Knife Grinder, Diamond
Planer, single surface, 26" x 6', Clement.
Planer, single surface, 30" x 6', Fay
Pony Planer, single surface, 24" x 8', Frank
Four-sided Planer and Matcher, 6 rolls, 24" x 4', Connell & D.
Four-sided Planer and Matcher, 6 rolls 24" x 4, Powers
Good Luck Hand Planer and Jointer, 16", Bentel & M.
Glue Jointer, 6' 6", with drop head, Buss.
10" four-sided Inside Moulder, Woods
6" four-sided Outside Moulder, Frank
24" Pattern Makers' Lathe on 10" wood shears.
Edge Sander, Young
No. 7½ Combination Saw and Dado Machine, Rowley & H

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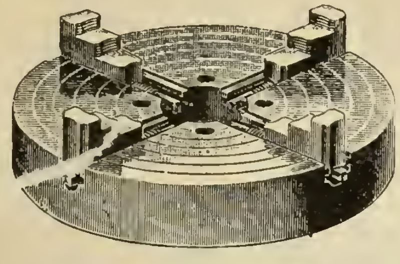

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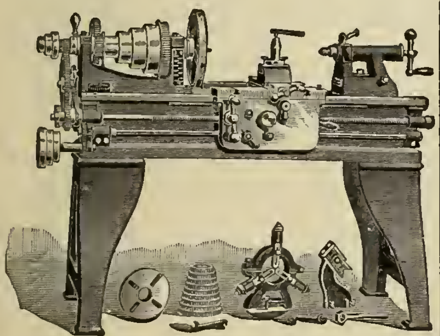

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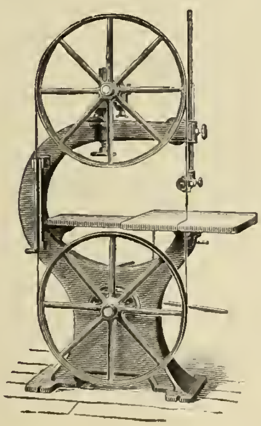

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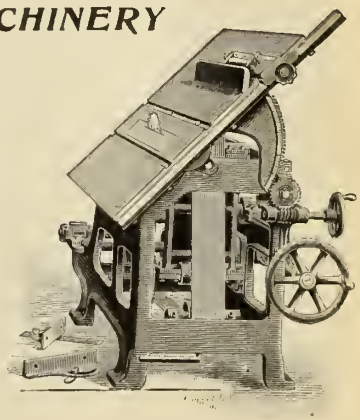

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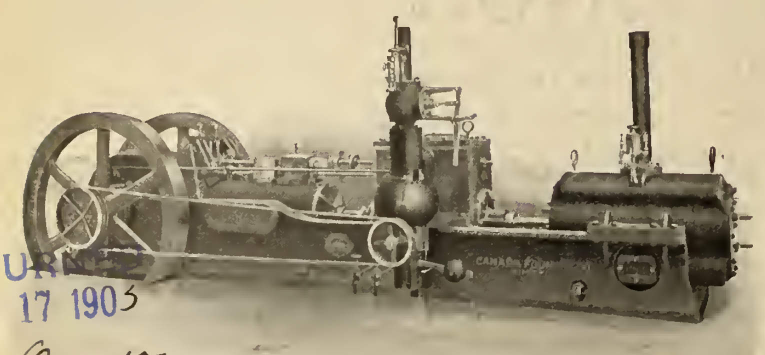

To Owner
cut Book 33.
page 60

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ANY PRESSURE ANY CAPACITY
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AT FULL LOAD WILL NOT INJURE THIS

GENERATOR

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"Johnson"
(PATENTED)

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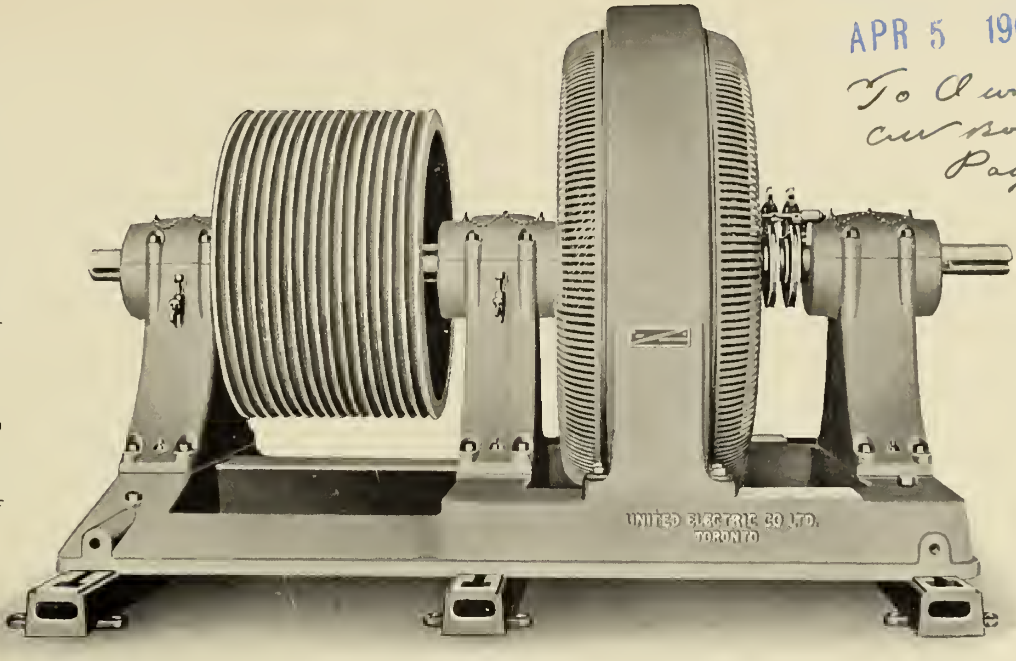

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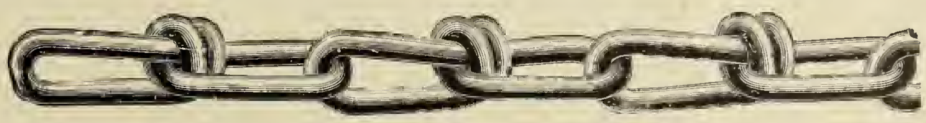

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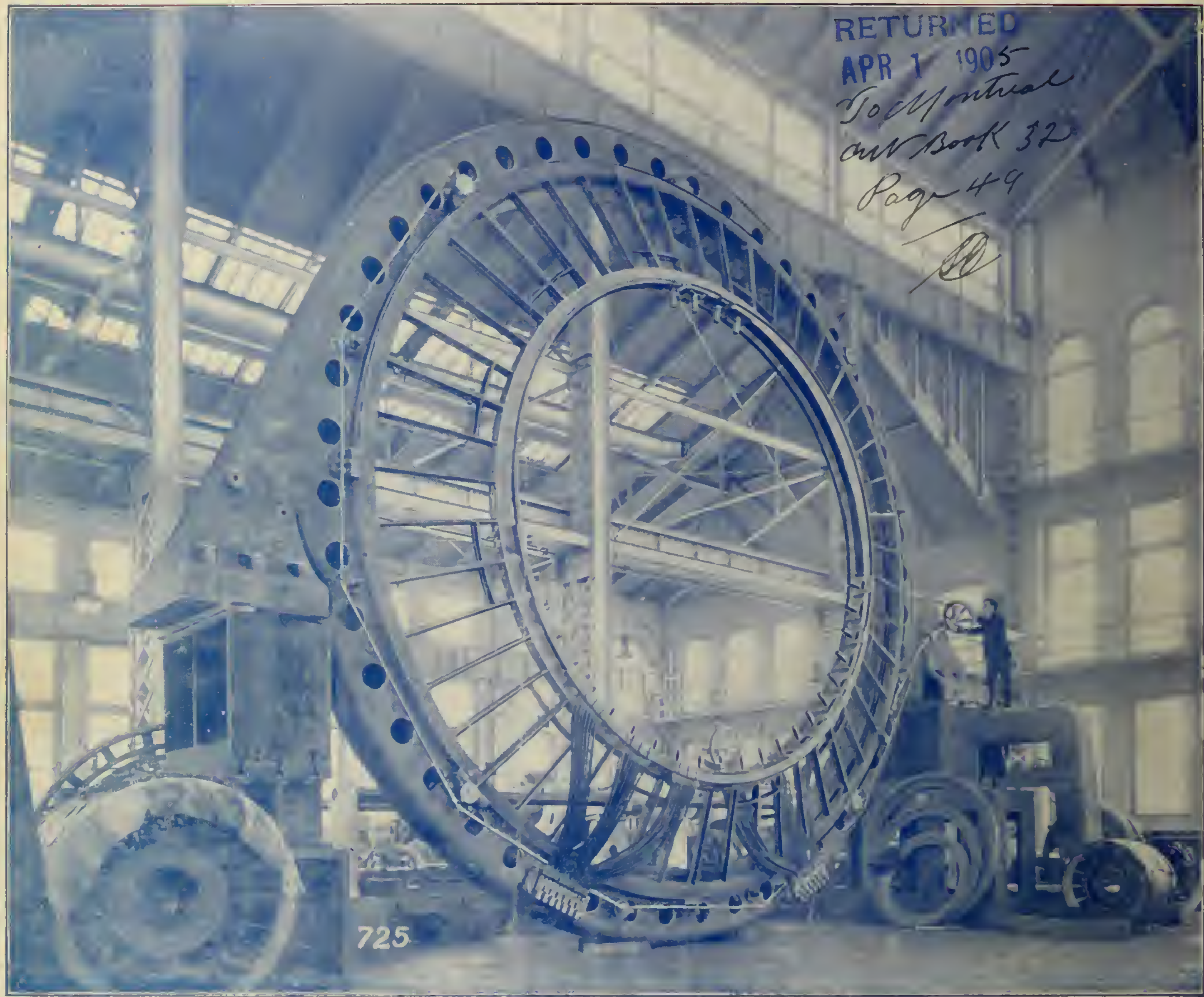

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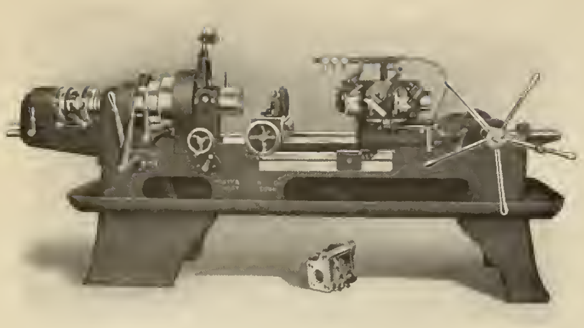
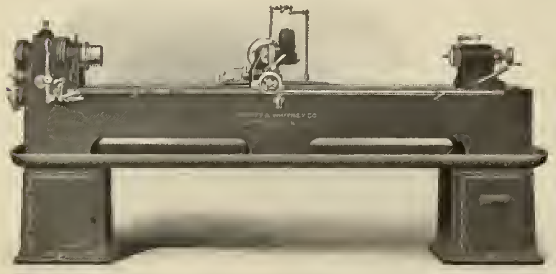
VOL. XVII. (Old Series) MONTREAL AND TORONTO, APRIL, 1905. (New Series) VOL. I. No. 4.



3 x 36 inch Turret Lathe. Five sizes. The most powerful, rapid and accurate machines on the market for rod work up to 3 inches in diameter; also for chucking work.



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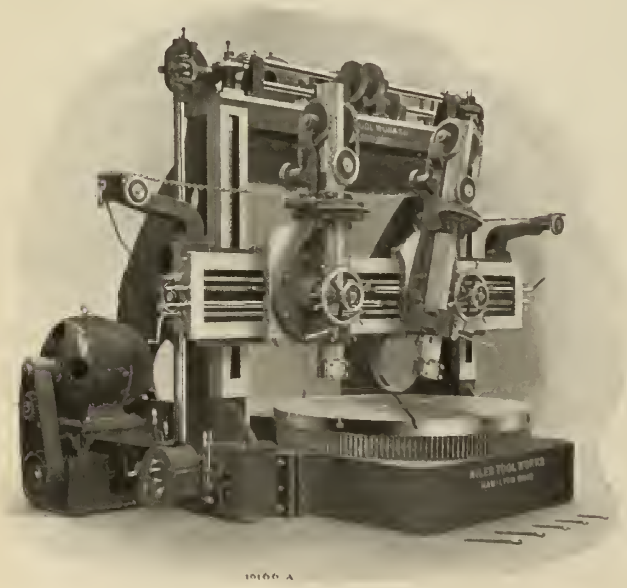
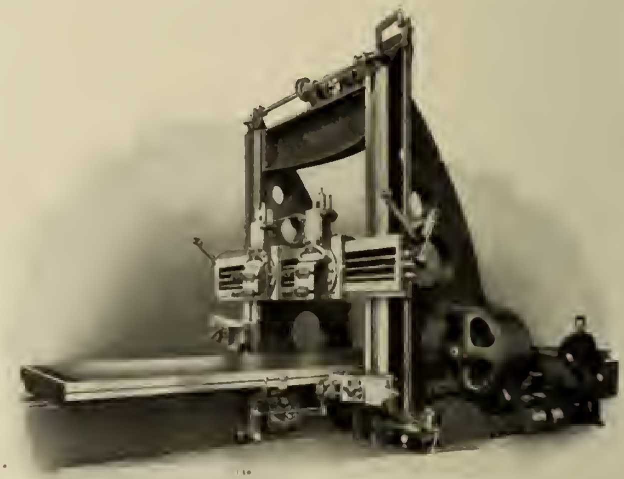


Nile's 10-foot Boring and Turning Mill.



10-foot Planer, Pneumatic Clutches. No Belts.

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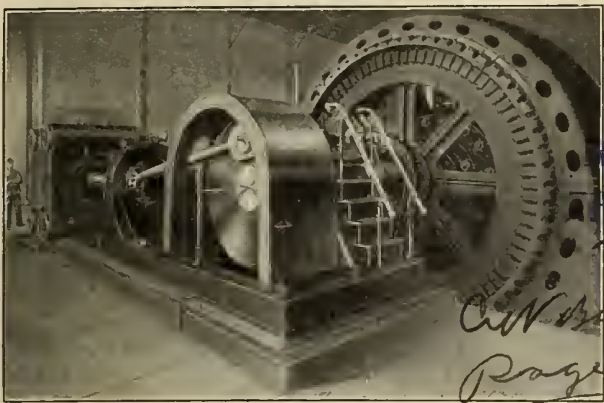

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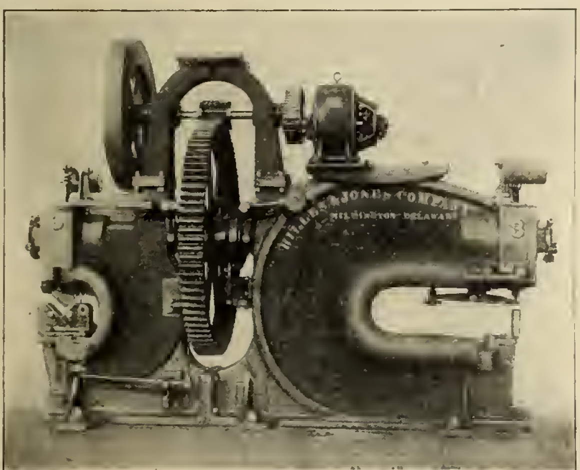

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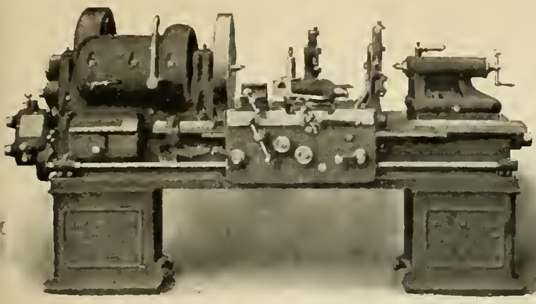

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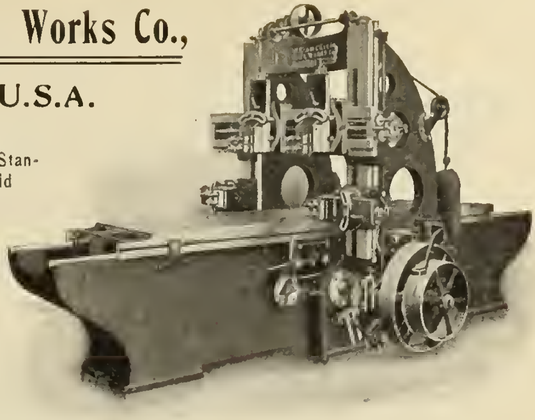

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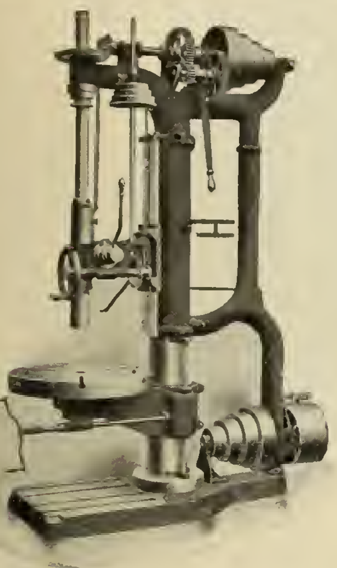

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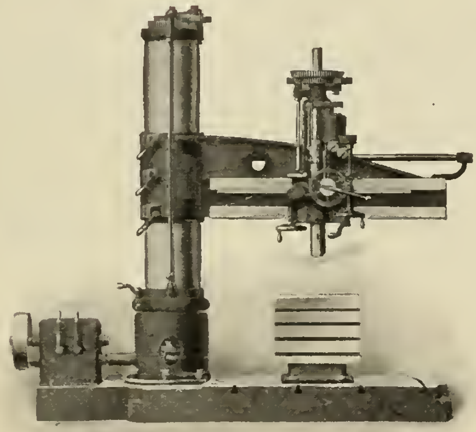

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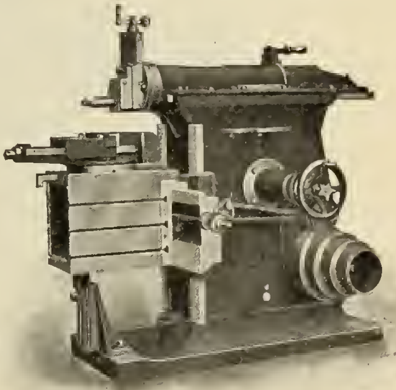

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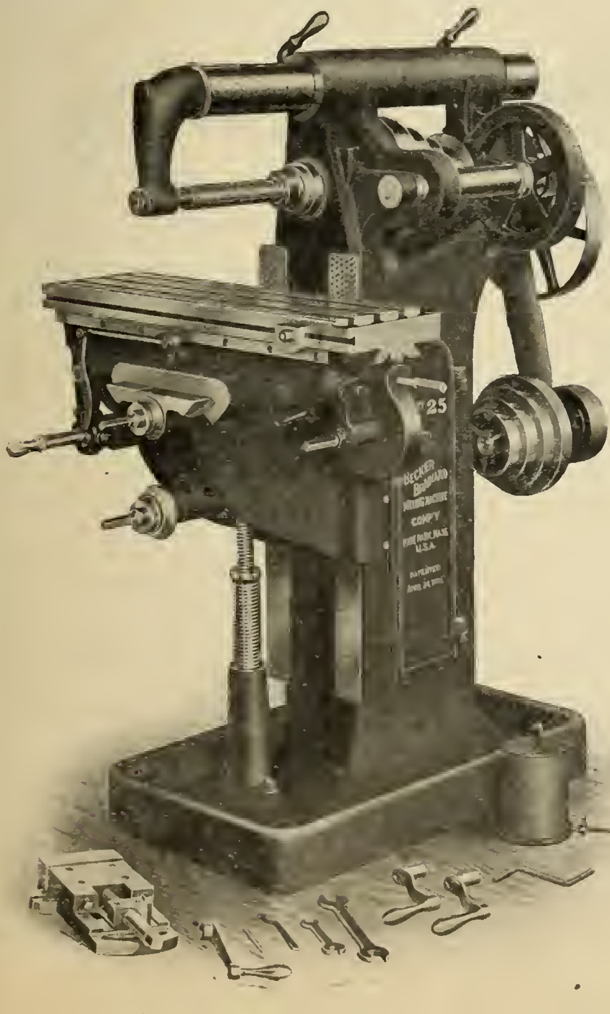

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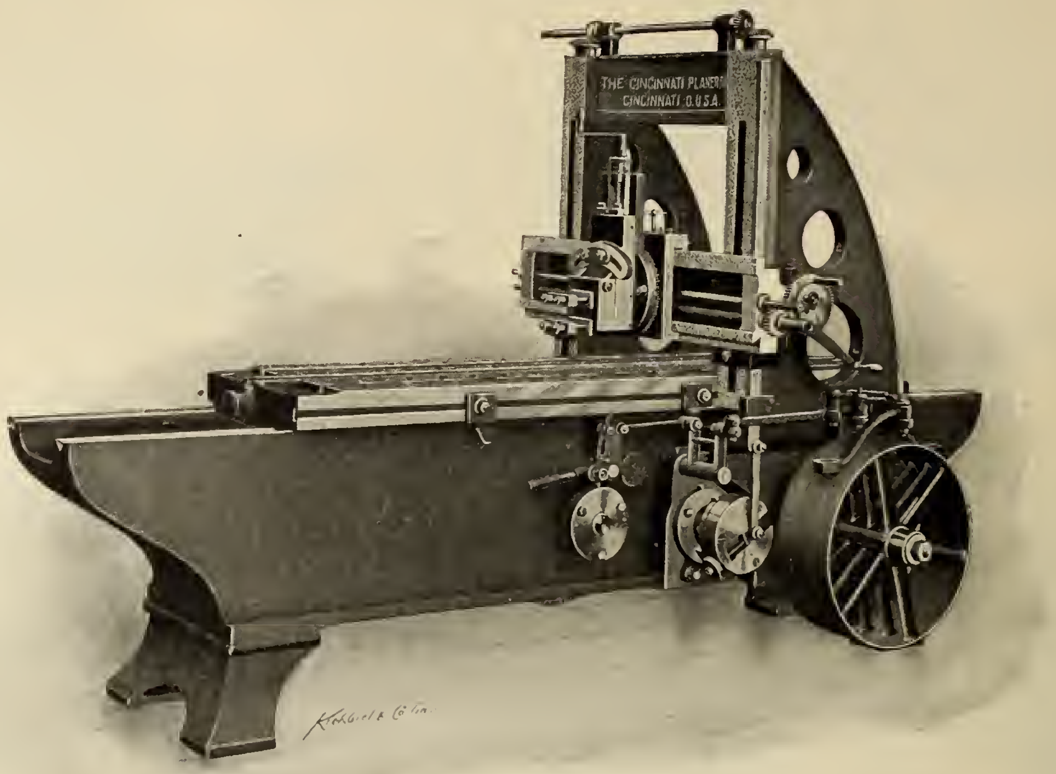

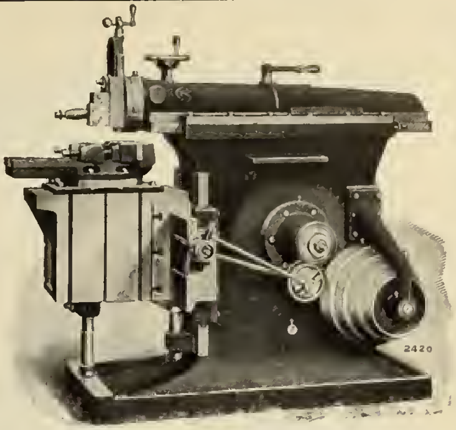

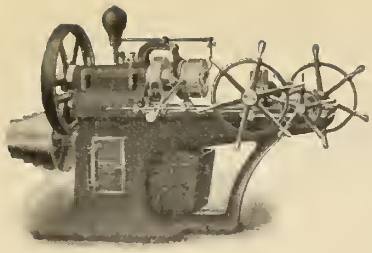

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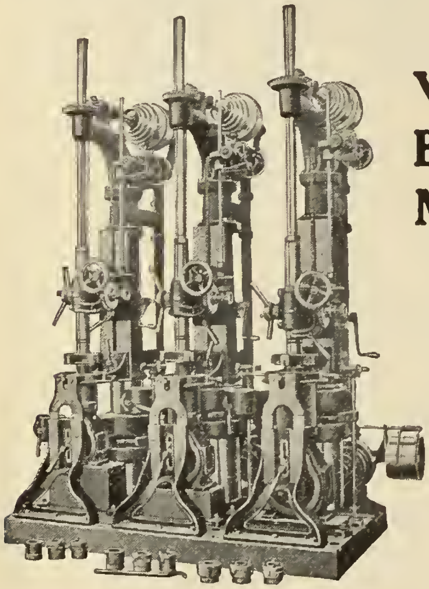

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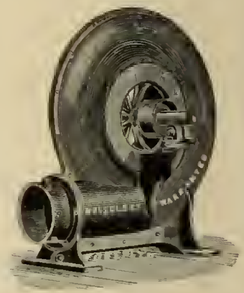

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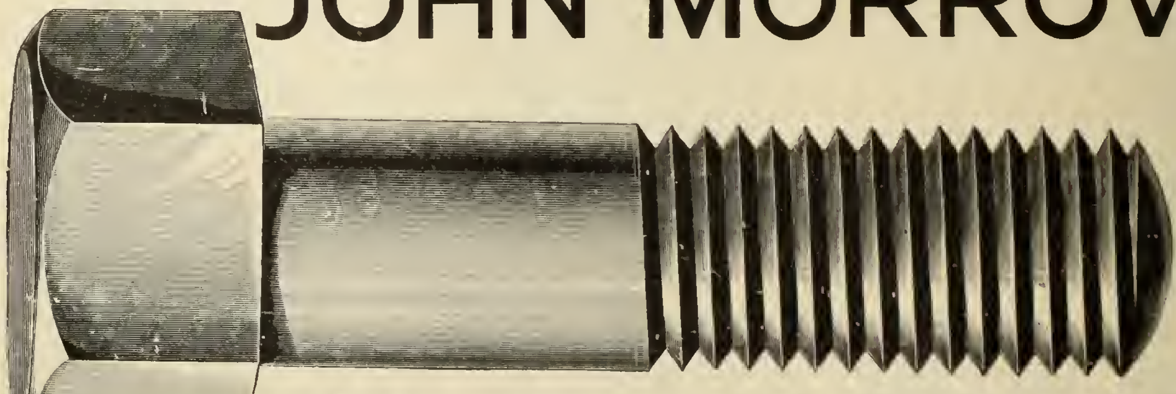

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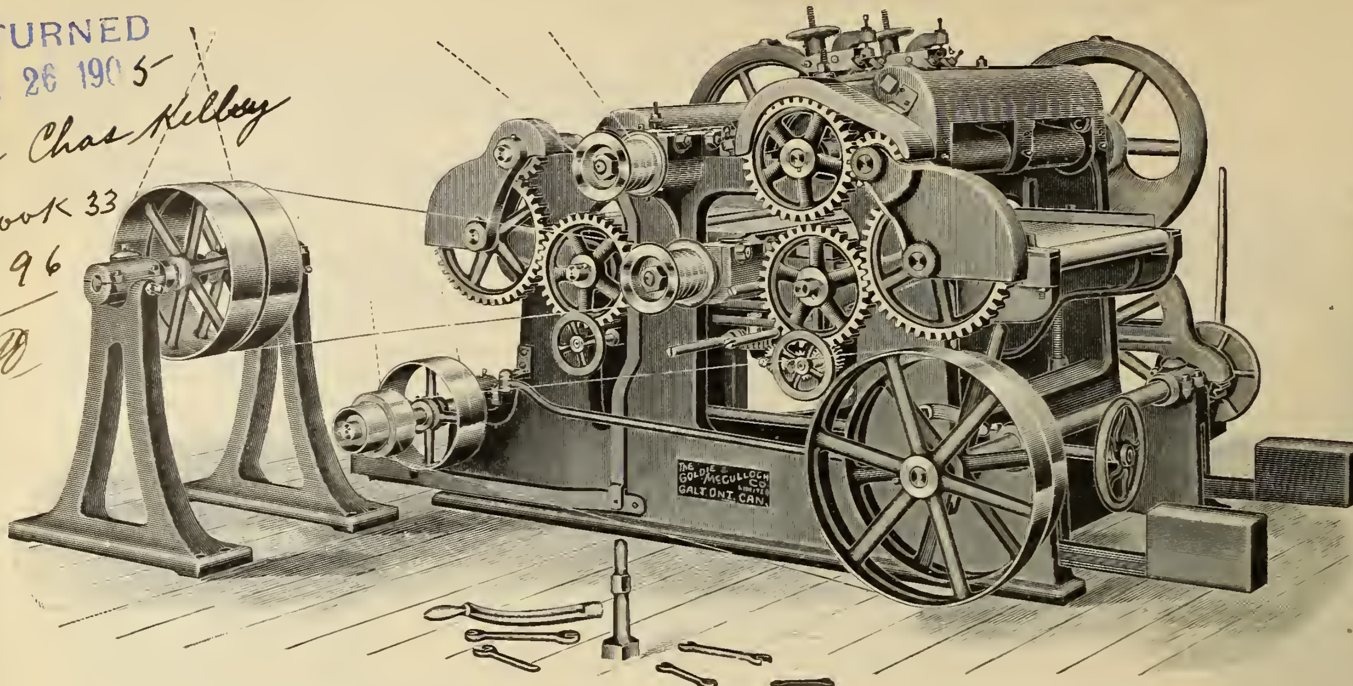
To Mr Chas Kelley
Cut Book 33
page 96



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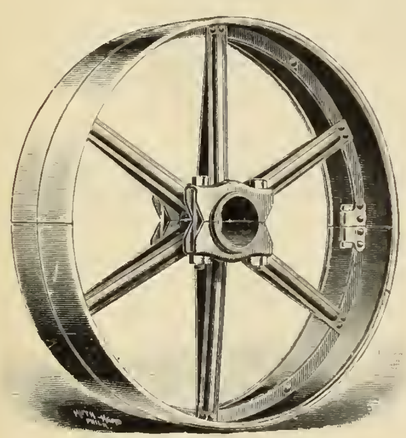

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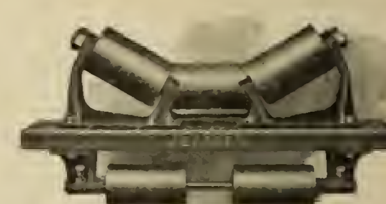

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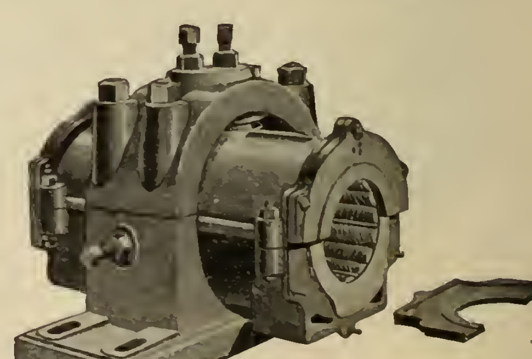

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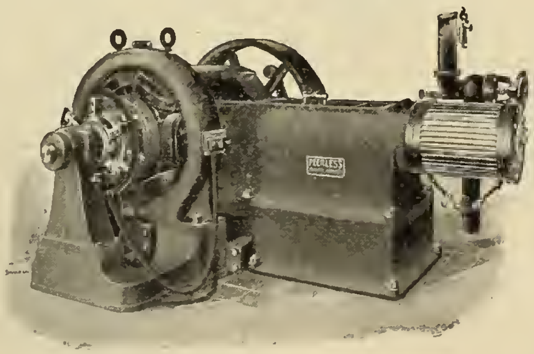

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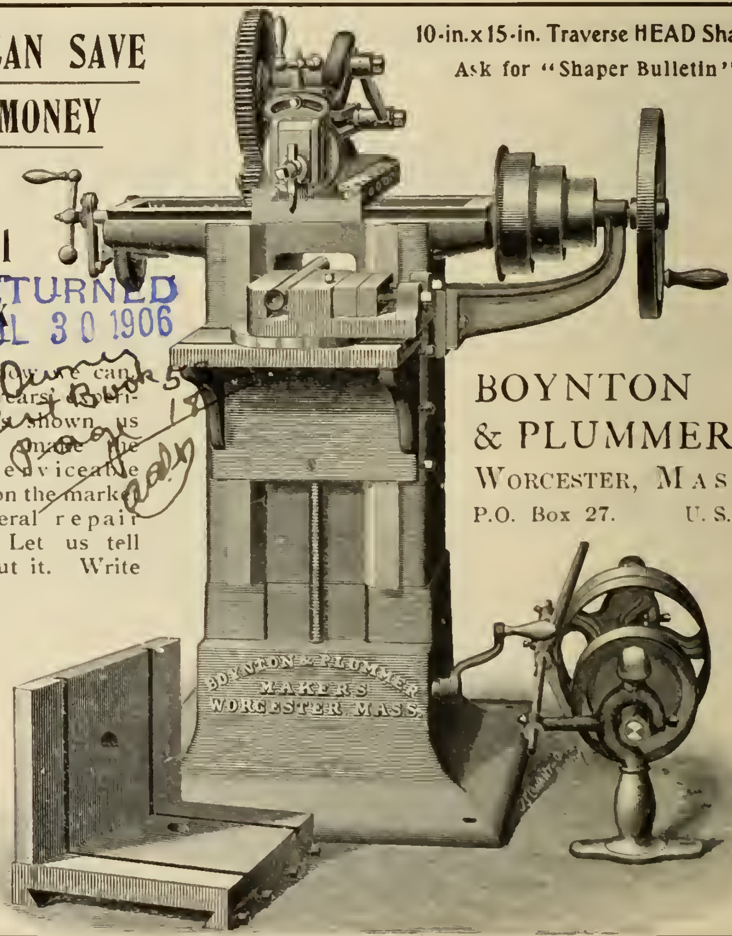

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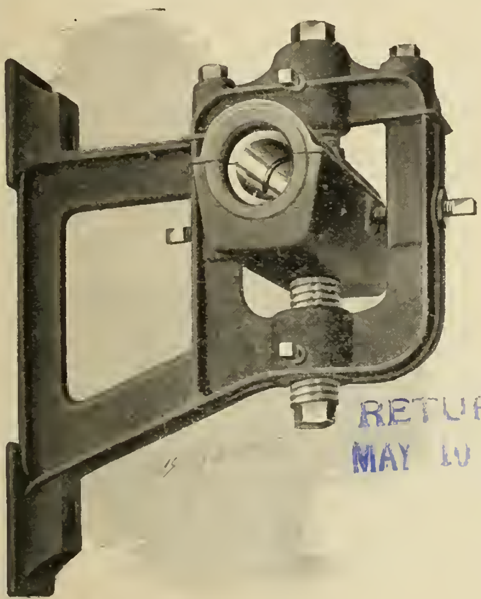

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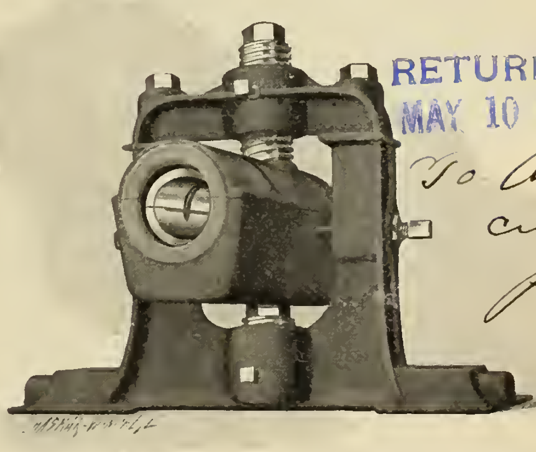

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Modern Canadian Manufacturing Plants

ARTICLE IV.—Planing Mills, Canadian Pacific Railway, Angus Shop, Montreal.

AT the Angus Shops, Montreal, is to be found one of the most complete wood-working establishments on the continent. It is but a unit in the general scheme that places these shops amongst the greatest works of their kind. In looking at the diagram of the arrangement, the location of the different buildings is easily noted. Here it is proposed to maintain the rolling stock of the eastern division of the C.P.R., and at which over 4,000 men are at present employed, with the expectation of increasing to 10,000 in the future.

Situated in the north-eastern part of the City of Montreal, on the main line of the C.P.R., 127 feet above the sea level, and at considerable distance above the surrounding country, the location is an ideal one. The plant occupies a rectangular space about 4,700 feet long, and 2,000 feet wide. The buildings are arranged on each side of a passage or mid-way along which runs a 100-ton crane, enabling material to be easily transferred from one shop to any other. The first building to the left at the south-east end of the mid-way is the locomotive shop, including the erecting and machine shops, boiler and tank shops, and is the largest of its kind ever erected, being 1,167 ft. 4 in. long by 162 ft. 8 in. wide. On the opposite side is the general store-house. The next building on the right-hand side is the blacksmith shop, which is L shaped with the long side parallel to the mid-way. Across from the blacksmith ship is an iron foundry, following which on the left-hand side is the pattern shop. Behind the latter is a fire-proof building for pattern storage.

After this is the car machine shop, then the truck shop and the last building on the left-hand side is the freight car shop. Opposite the freight car shop is the planing mill, the subject of this article, which is set back at some distance from the mid-way. Between the planing mill and the blacksmith shop is the power house, and behind these are located two large passenger car shops, with a 75-ft. transfer table running between them. The cabinet shops and upholstering rooms are located nearby. The lumber yards and repair yards are to the west of this group of buildings, in a location convenient to the planing mill.

In the planing mill all the lumber going into the make-up of the cars, with the exception of the hardwood used in finishing, is dressed. From the sills, which are 5 in. by 8 in. by 72 ft., and the truss plank, 3 in. by 10 in. by 72 ft., down to the window battens and stops, 3-16 by ½ in., the material leaves the planing mill ready to take its place in the general construction. The building itself is 126 by 500 ft., built of brick on concrete foundations, with a wooden roof truss. A row of built-up steel columns support the truss along the centre and divide the building into two bays. Along one of these the material for the passenger cars passes, and along the other for the freight cars.

Planing Mill, Angus Shops—Looking East.

Transportation.

A supply track passes down the centre of each of these bays, and a track from the dry kiln passes across the building with turn-tables at each of the longitudinal tracks. These longitudinal tracks extend across the mid-way and a short distance into the car shops, which allow long sills and other heavy wooden parts to be carried beneath the trains in the freight car shop. They also ex-

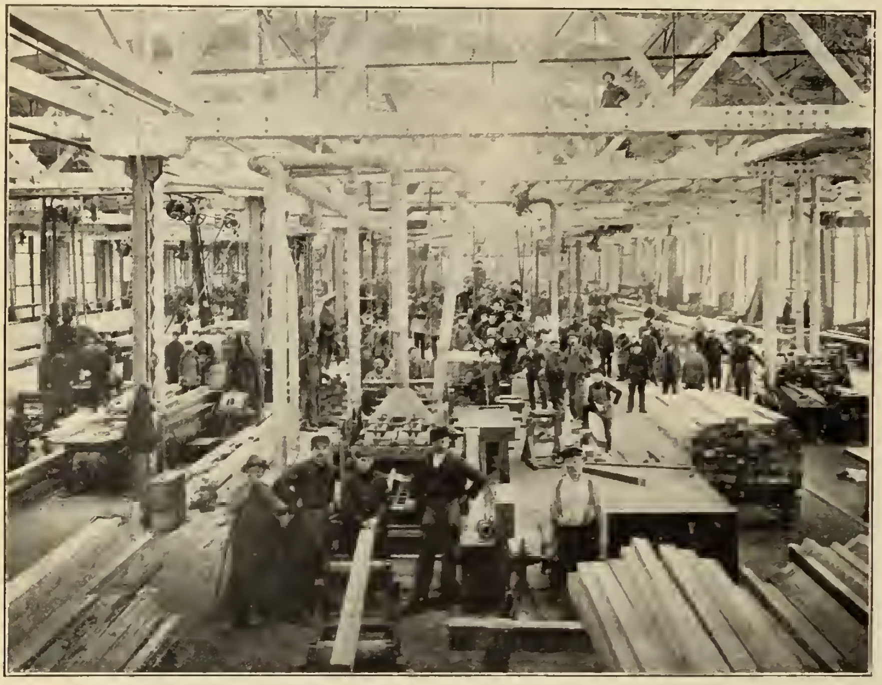
tend through the opposite end of the building and connect to the numerous tracks through the lumber yard.

Water Service.

Water service for the entire plant is mostly available from the city mains. There are two systems, one of 35 lbs. pressure for ordinary use, and one of 90 lbs. for fire service. Besides the city main the shops have their own supply of water taken from two artesian wells six inches in diameter and 55 ft. deep, from which a supply of nearly 20,000 gallons per hour is obtained. An open reservoir 66 ft. in diameter, with a capacity of 500,000 gallons, gives an additional supply. This reservoir is situated back of the blacksmith shop near the power house, and is intended as an emergency supply for power purposes. A 75,000-gallon steel tank, 50 feet in height, is located in front of the power house, giving a steady pressure on the supply heights. The supply system has a 6-in. main pipe in the tunnel running alongside the mid-way, with smaller connections diverging to the different buildings. About 60 three-way hydrants are situated on different parts of the grounds. An automatic sprinkling system is also connected with the fire mains, completely covering all the buildings, particularly those devoted to wood-working. In the entire plant there are about 13,000 sprinklers.

Heating.

The problem of heating the buildings was a serious one, and was not decided until after a great deal of thought and deliberation. It was finally decided to adopt the hot-blast system, and the exhaust steam in the power house is used exclusively for this purpose. The steam is carried in pipes through the tunnels to the different buildings, and has a maximum distance of over half a mile to the furthest building. It is carried through the heating coil arranged on the Sturtevant system, and the heated air is forced out at different points in the building at a temperature of about 130 degrees. These points were determined by the character of the work and the building to be heated. The exhaust steam, after passing through the coils, is pumped by a vacuum pump back to the hot valve in the power house. Each fan has its own vacuum pump. The specifications for heating required the buildings to be heated to a constant temperature of 65 degrees, when the outside temperature is 10 degrees below zero.



Planing Mill, Angus Shops— Looking West.

Method of Power Transmission.

The power house of the Angus Shops contains three 500 k. w. Canadian General Electric Co.'s alternating current generators, direct connected to three 21 and 33x21 horizontal cross-compound non-condensing Robb engines; one 250 k. w. C. G. E. alternating current generator direct connected to 18x21 Robb simple engine; two 50 k. w. C. G. E. exciters direct connected to two 10x12 Robb Armstrong engines; and two 200 k. w. C. G. E. direct current generators direct connected to 10x20 Robb-Armstrong engines, for driving the motors and lighting the different buildings. In the planing mill, group and individual motor driving is used throughout; for most of the machines individual motors are employed, and group driving for some of the smaller machines. The combined horse-power of the alternating current motors in the planing mill is 1,750.

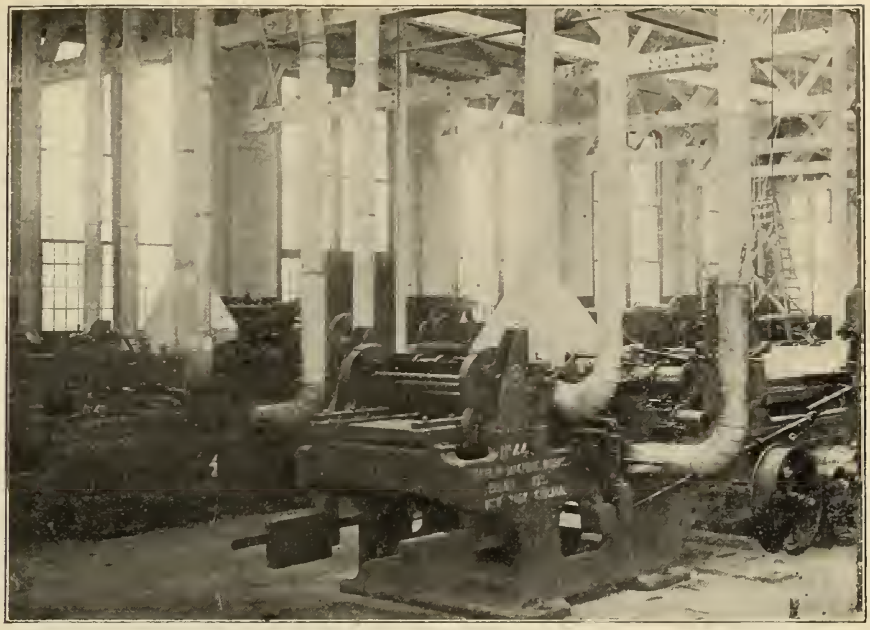
Machines Installed.

From the drawing showing location of the machines it will be noted that the machines for the heavier woodwork are located along the west longitudinal track, where the work can be easily transferred to push cars and taken to the freight-cars erecting shop directly opposite the mid-way. A list of the machines is given here, together with the horse-power rating of the motor driving the individual or the group :

No. 8, Berlin planer and sizer....50 H.P.
No. 3, Greenlee rip saw ....20 H.P.
No. 6, Fay outside moulder.......30 H.P.
No. 8, Berlin planer and sizer...50 H.P
Group No. 174........... ....10 H.P.
  Bandsaw filer.
  Fay auto knife grinder.
  Perth knife grinder.
  Emery wheel.
  Circular saw sharpener.
No. 3, Greenlee rip saw ....20 H.P.
No. 3, Greenlee rip saw .. . .20 H.P.
No. 24, Berlin planer & matcher.30 H.P.
Buzz planer...... .... 5 H.P.
Fay 1-head dimension planer.......40 H.P.
Four-head matcher and planer....20 H.P.
No. 6, Greenlee cutoff saw..........15 H.P.
Bertram large rip saw... ....15 H.P.
Bertram large butting saw ....15 H.P.
Bertram horizontal gainer ....20 H.P.
Group No. 186......... ....15 H.P.
  No. 2, Greenlee auto cutoff saw.
  No. 5, Greenlee auto cutoff saw.
No. 14, Greenlee mortiser .... .15 H.P.
No. 5, Greenlee auto cutoff saw ..15 H.P.
Greenlee heavy car-boring machine ..: ....20 H.P.
No. 3, Fay ripping saw .. ..20 H.P.
Group No. 188A ....15 H.P.

Boiler Room, showing Dust Conveyors.

  Bertram horizontal gainer.
  Greenlee 3-spindle boring machine.
No. 2, Fay ripping saw ....15 H.P.



Group of Machines

Group No. 190... ....20 H.P.
Greenlee 5-spindle boring machine.
Greenlee 3-spindle boring machine.

Group No. 191........... ... .15 H.P.
Three-spindle boring machine.
Swing cutoff saw.
Greenlee sill mortiser.

Vertical end tenoning machine...30 H.P.
Mortiser and boring machine......15 H.P.
No. 6, Fay mortiser and borer...10 H.P.
No. 14, Greenlee mortiser ....15 H.P.
No. 3, Greenlee gainer ....15 H.P.

Group No. 196...... ....20 H.P.
Greenlee boring machine.
40-ft. table.
Swing cutoff saw.

Group No. 197.............. ....20 H.P.
Greenlee boring machine.
40-ft. table.
Swing cutoff saw.

No. 3, Greenlee gainer, 40-ft. table ... .15 H.P.
No. 4, Greenlee tenoner ....15 H.P.

Group No. 200...... ....20 H.P.
No. 14 Greenlee mortiser, 40-ft. table.
No. 58, Fay band saw.

Group No. 201...... ....20 H.P.
Fay band saw.
Boring machine.
Bertram gainer.

Group No. 202...... ....40 H.P.
Two No. 5 Greenlee horizontal can tenoners.
Two Bertram horizontal tenoners.

Group No. 203...... ....40 H.P.
Fay 3-spindle boring machine.
Rip saw.
Fay vertical gainer.

Group No. 204...... ....15 H.P.
Greenlee 3-spindle boring machine.
Gainer.

Group No. 205...... ....20 H.P.
Double-headed shaper.
Hollow chisel mortiser.

Four-headed sticker ....20 H.P.

Group No. 207... ....15 H.P.
No. 3 Greenlee cutoff saws and gainer.
Shaping machine.

Group No. 208.. ...... 10 H.P.
Double-headed shaper.
3-spindle boring machine.

Group No. 209... ....10 H.P.
Horizontal tenoning machine.
Band saw.

Moulding machine ....10 H.P.

Group No. 211...... ....30 H.P.
Swing cutoff saw.
Circular saw.
Buzz planer.
Rip saw.

Group No. 212........ ....20 H.P.
Vertical sill tenoning machine.
Greenlee car boring machine.

Band re-saw ....15 H.P.

Group No. 214.............. . ...15 H.P.
Cutoff saw.
Band saw.
Dimension saw.

Collecting Bins on Roof.

Single Installation.

This incomplete list will give some idea of the amount of machinery in operation, which when worked to its full capacity is capable of preparing the woodwork for twenty-five cars a day.

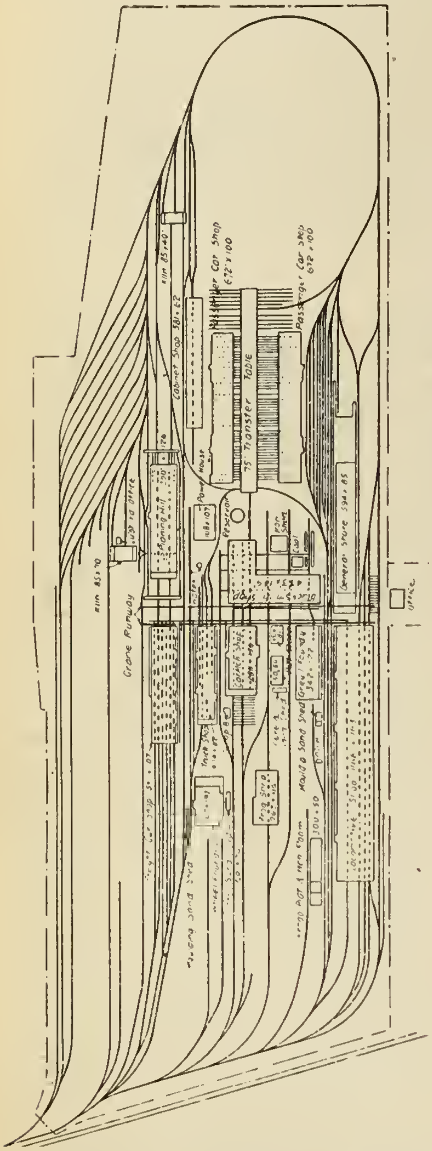
Motors.

Induction motors are used throughout, varying in size from 50 h.p. to 2 h.p. They require very little attention, and

may be operated in any position; in some cases in this installation they are suspended from the ceiling, adjustment for different positions being made simply by turning the And shields, which support the bearings, 90 or 180 degrees from their original position, as the case may demand.

Saw Filing and Sharpening Departments.

Situated at the western end of the mill is a gallery for grinding the machine knives and saws. Some of these



Location of Buildings and Track Connections, Angus Shops, C. P. R.

are of peculiar interest, being entirely automatic. Included in the list of machines here are 2 saw filers, 2 emery wheels, 1 surface grinder, 2 automatic band saw files, automatic knife grinders and automatic circular saw grinders. In these latter machines a circular saw may be placed and each tooth finished in turn with an accuracy impossible by hand labor.

Dust Collecting System.

One of the most important features in connection with the planing mill is the system of collecting saw dust, shavings and trimmings from the different machines and conveying them to bins on the roof of the building and eventually to the boilers in the power house. This system was installed by C. H. Gifford & Co., managers of the Philadelphia house, B. F. Sturtevant Co., and is undoubtedly the largest dust-collecting system on this continent.

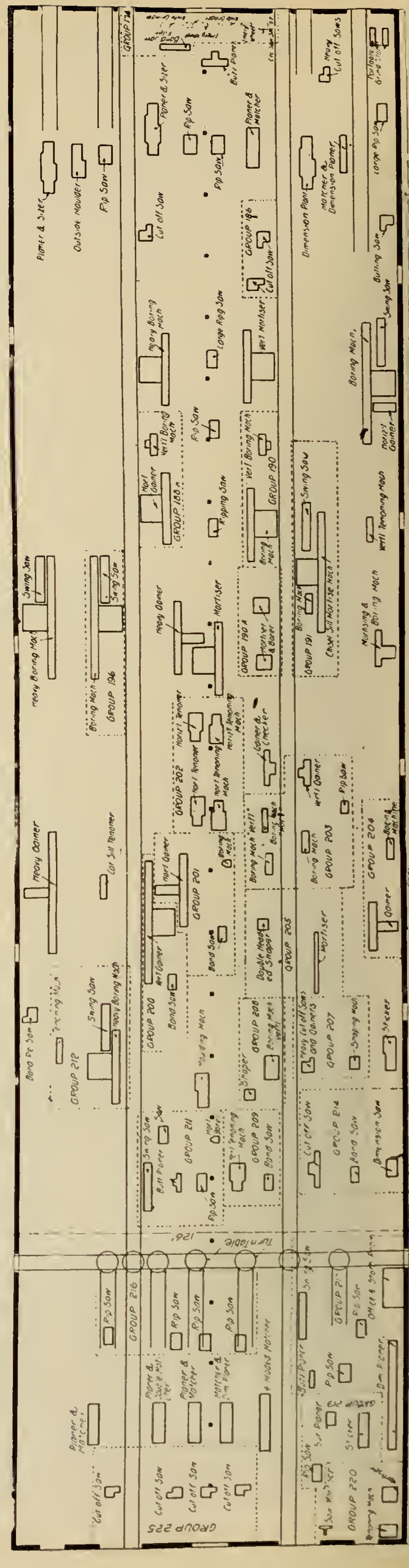
The equipment consists of seventeen exhaust fans and six enormous dust collectors. Three of these are located up on the roof of the planing mill, and one planing mill is drawn up with facility and discharged to the collectors. This stock is largely oak, wet, heavy and stringy, with frequently an inch of ice which is taken off at the same cut. The upon the cabinet shop, while two others into which they discharge are supported above the boiler house. All of the wood-working machines are hooded in the most approved manner, so as to insure the maximum suction at the point where chips and shavings are made.

Not only can the light, thoroughly dry refuse from the cabinet shops be handled in this way, but that which is made by the heavy machines in the fans vary in speed from about 650 to 825 revolutions per minute. The greatest distance through which material is conveyed is about 700 feet.

The efficiency of the system as compared with any method of collecting refuse by the hand is two-fold in its character. Not only is the expense of handling greatly reduced, but the refuse material is at once rendered available for fuel.

The boilers, which are four in number of about 425 horse-power each or 1,700 horse-power total, may be fed entirely by shavings which would otherwise be costly to transport and dispose of. At the boiler house are located additional fans, which draw the refuse from the first set of collectors and discharge it to the second set, from which it is delivered either directly to the boilers or deposited in the shaving house. When the boilers are not in operation and the surplus is too great, it is also possible to deliver directly to cars, beneath pipes and between the boiler and shaving houses. The feed pipes of the boilers may be swung out of position when not required.

This installation is an illustration of the high efficiency of operation which may be secured by careful and thoughtful design. The power required to operate the fans is fully one-third less than that which would be necessary if the system had been installed along the lines which prevail in similar installations. The annual saving in power will probably be enough to pay the total first cost of the additional equipment to secure the increased efficiency.



Location of Tools in Planing Mill, Angus Shops, C. P. R.

The General Scheme of Cost-Keeping

—By G. C Keith.

EVERY manufacturer knows the use and advantage of the cost department. To be of most use the system must be simple, accurate, systematic, economical, and complete. The system employed must be adapted to his own special requirements.

In a cost system there are several branches. A cost-keeper, a time-keeper, and a store or stock-keeper, are required, and in most establishments where the superintendent cannot give direct attention to the buying, the office of buyer is added, and in industries such as tool works or agricultural implement manufactories, there is also the office of shipper.

In all factories a general scheme may be adopted, but in detail there are many differences. In an agricultural or tool works, where many thousand of each article are made, it would be impossible to trace the cost of every single article without an enormous needless expenditure. In the case of steam-engine or locomotive building, it is different. If an order be given for fifty engines or locomotives, the cost of each part may be easily traced through the different shops.

In the cost system the material is of first consideration. It is the duty of the cost-keeper, or his stock-clerk, to keep exact records of all the material in stock. When an order is given for material a record of the order is kept, and the stock when it arrives is checked by the storeman. The raw material, such as pig iron, lumber, etc., is purchased by the buyer under the supervision of the superintendent. This material must be ordered several months ahead of the time when it is required for use. The stock-keeper informs the buyer from time to time as to the amount of material in stock. The supply on hand should depend on the markets. If prices are advancing an order should be given so as to secure the stock at a lower cost than would be otherwise obtained. Then, on the contrary, if the superintendent thinks there will be a break in prices, he might risk getting in a small supply.

When an order comes to a firm for a number of steam or gas engines, lathes, locomotives, or the management decides, according to demand and experience, to build a certain number of mowers, binders, or other agricultural implements, the superintendent notifies the head draughtsman, or, in the case of agricultural implements, the buyer, who, according to experience, calculates the amount of material required to fill all orders and have none left at the end of the season. A list is sent to the store-keeper, who knows what material is on hand and an order is made out for sufficient to complete the contract. The head draughtsman gets out the necessary drawings and supplies the foremen of the different departments with them. From these the foreman makes out his order or requisition, which is presented to the stock-keeper for a certain amount of bar iron, mountings, piping, etc. This order must give drawing number and name of particular part of machine for which the material is required. The material is entered on cards for the purpose of giving the cost and amount used. When the stock runs low more is ordered. Any material left over is returned to the storeman, who credits the article and contract with the amount returned. This system finally becomes mechanical and can be handled by a clerk.

From the foundry statement we obtain the cost of melted iron. We have the weight of the good castings and the weight and cost of pig iron, coke, etc., put into the cupola, and cost of cupola labor, so we can get the cost of good castings, which will be in proportion to their weight. To get the total cost we add on a percentage for non-productive labor, which includes foreman, watchmen, clerk, etc. This percentage is calculated on the productive labor, and is the average for years. This percentage is also added to obtain the total cost of any part of engine or machine.

It is the time-keeper's duty to register the time of employe entering and leaving the works. He gives to each man a check, numbered according to the shop in which he works. Where a piece-work or time-limit system is used, each man is supplied with a card on which he enters his work and time for the day. Each pay, which is usually twice a month, or every fortnight, the premium workers hand in a statement of the amount of work finished. The statement is checked by the foreman if correct. In tool or agricultural works the number of articles and operation performed on them is given in each day, and the fortnightly statement is unnecessary. The premium system is therefore a great aid to cost-clerk, and thus to the superintendent, who can see at any time the work finished in the shop. Very little additional cost is entailed in getting the work done by the day laborers, and the cost-keeper has then the material and labor for each particular part of machine.

The cost system is necessarily a system of cards. It has many advantages over the book system. It is a system of rapid compilation. There is no lost time, as in the book system, if the superintendent wishes to examine the cost of any particular part. He can do so without stopping the cost-clerk's work. With the premium system the cost-clerk can, with a small amount of labor and cost, keep a record of employes, weight of castings, etc., and the cost-office becomes, really, the superintendent's information bureau.

For the system several cards are required—time-cards in colors, and labor

IMPLEMENT MANUFACTURING CO., Limited

PIECE-WORKERS' TIME CARD

No 110

MR. J. ELDORA. March st, 1905

PREMIUM WORK

AMOUNT FINISHED	PATT. NO.	NAME	OPERATION	HOURS	RATE PER 100
700	1603	Mower Guards	D.	7	18
700	1603	Mower Guards	C.S.	2½	3

DAY WORK

2	Bands for Rumbler	D	½	

cards to correspond—on which is entered the labor on an article through the different shops, orders for material, which, if necessary, may be in colors; piecework cards, foreman's orders, fuel and pattern record vouchers, credit memos, specifications, etc. The accompanying would be the form of a piece-worker's time-card, handed in each day to the time-keeper :

The most useful system, therefore, is the one which is most complete, yet simple, giving full information, such as stock, work finished in each department, a system which shown any defect and its cause, and the quantity and quality of work in the different departments. With such a system as has been hinted at, a manufacturer can tell exactly how he stands, whether or not he will have a profit, and if not, the reason of the loss, so that it can be at once rectified. Everything must be accounted for; the leaks are stopped and the details of the business coming to the direct notice of the superintendent, he is better able to keep the efficiency of the works to the highest point.

PERSONAL MENTION.

Mr. Thomas A. Edison is rapidly recovering from a recent operation so that he is enabled to be in his laboratory as usual.

Mr. R. S. Kelsch, of Montreal, was appointed consulting engineer for Calgary in connection with the establishment of municipal lighting systems. A municipal plant is to be installed in the face of bitter opposition from existing companies.

Prof. L. A. Herdt, A.M.I.E.E., A.M. Can. Soc. C.E., master of electrical engineering of McGill University, Montreal, has received from the Government of France the honorary title of Officier d'Academie, a distinction granted for services rendered in the field of art, science, and literature.

The town of Milton, Ont., has retained Mr. K. L. Aitken, of Toronto, as their consulting engineer in connection with the rebuilding of their electric light plant. A new power house will be built and machinery, consisting of boilers, engine and switchboard, installed, and in all probability the present system of distribution will be changed.

Signor Marconi, who was married on March 16, to the Hon. Beatrice O'Brien, arrived in Montreal on Monday, April 10. He intends taking up the work of testing the new plant at Glace Bay in the near future. The equipment is nearly ready and a severe test is to be made when it is expected that rapid messages will be transmitted to their station in Cornwall.

The Montreal branch of Fetherstonhaugh & Co., patent barristers, solicitors and experts, has been taken charge of recently by Mr. C. W. Taylor, a graduate in electrical engineering of McGill University, and for several years examiner in the Canadian Patent Office at Ottawa. Mr. Albert F. Nathan, formerly in charge of the Montreal branch, has opened up an office for the firm in New York. The head office remains as before under the personal direction of Mr. F. B. Fetherstonhaugh. The clientele of this firm has been considerably extended of late necessitating the opening up of their New York office.

Mr. Geo. B. Damon, recently manager of the New York office of the Wellman-Seaver-Morgan Co., of Cleveland, Ohio, has been transferred to an important position in connection with the engineering and sales department at Cleveland. Mr. W. A. Stadelman recently manager of the Brown Hoisting Machinery Co., and widely known by his connection with the Sprague Electric and Motor Co., as chief engineer of the Equitable Electric Railway Construction Co. and general manager of the Bristol Belt-Line Railway Co., has become manager of the general eastern office of the Wellman-Seaver-Morgan Co., with offices at 42 Broadway, New York City.

A TRANSPARENT DRAWING BOARD.

A GREAT convenience for the draughtsman, which has recently been put before the public by an English firm, is a transparent drawing board, the feature of which is a plate of glass, one-quarter of an inch thick, which is sunk into a wooden frame so the edges of the wood and glass are quite flush with each other. Convenient bars are arranged across the apparatus, on which the originals to be worked over are fastened, and there is also a rest for the forearm of the draughtsman while at work. The board may be tilted at any desirable angle, and held at the proper point by two props, which fold up into the frame of the device when it is desired to pack it away. A mirror is swung under the glass, which can also be fixed at any suitable angle, and the light reflected by this can be made to strike under the work, and the task of copying a drawing thus made quite easy. Where there is a lack of light, the illumination may be supplied by means of a row of electric lights fitted along the edge of the board.

BOOK REVIEWS.

POPULAR MECHANICS' "Shop Notes, 1905," published by Popular Mechanics' Co., Chicago, price 50 cents; a book full of practical hints in connection with everyday work in the shop. It is made up of the articles appearing in the "Shop Notes" department of Popular Mechanics. Nearly every article is illustrated with one or more cuts, making a much clearer and more easily understood description. This book is a valuable one for machinists, blacksmiths, and metal workers generally, hesides containing scores of articles of great value to the average mechanic.

"Friction and Lubrication," by Wm. M. Davis, published by the Lubrication Publishing Co., Pittsburg, Pa. This is the second edition of this handbook taking up the subject from the standpoint of the engineer, the mechanic, the superintendent, or the manager. The book deals with the laws of friction and the theory of lubrication, the method of testing oils and their properties. Specific cases are cited and different types of machines mentioned, and the lubrication of them dealt with in an exhaustive manner. This book is valuable to all users of machinery, engineers, etc.

"Standard Electrical Dictionary," by T. O'Connon Sloan, A.M., E.M., Ph. D., tenth edition, revised and enlarged, Norman W. Henley & Co., publishers, New York. This is a popular handbook of reference, containing definitions of about 5,000 different terms, words and phrases used in the practice of electrical engineering. It is not only to the man connected with the electrical engineering profession, but to anyone wishing to familiarize himself with electrical terms, that this book is a necessity. It is profusely illustrated, and the different terms and expressions are explained in a concise manner.

"Mechanical Movements," by Gardner Hiscox, M.E.; Norman W. Henley & Co., publishers, New York. This book is illustrated by 1,800 engravings, and its popularity is shown by the fact that it has reached the tenth edition, which has been revised and enlarged. It comprises an illustrated description of mechanical movements and devices used in constructive and operative machinery and the mechanical arts.

"Electrical Magazine," first anniversary and American tour souvenir number. This issue of "Electrical Magazine" gives an exhaustive and fully illustrated description of the tour to America during the past year by the British and Foreign Electrical Engineers, who attended the International Congress of Electrical Engineers at St. Louis. It is written in a pleasing style by the editor of the magazine, who was one of the number, and who is to be congratulated on the splendid edition

The Knowing How

By W. H. Wiggs, Quebec.

"Responsibilities gravitate to the person who can shoulder them and Power flows to the man who knows how."—Elbert Hubbard.

THE intellect has always been and will ever be the dominating force in the advancement or decline of the human race. It is the thermometer, so to speak, by which one gauges the capacity of peoples, nations, families, and finally the individual. Some nations can only grasp comprehensively the numerals to the extent of five—the number of the fingers on one hand; beyond that they are lost in oblivion. Others, according to their intellectual training, can accurately grasp thousands at a glance.

It is beyond all dispute that the intellect is expansive, absorptive, and capable of being improved. A learned doctor has recently given his decision that a large percentage of mental diseases is caused by the non-use of our thinking and reasoning faculties.

The eyes are the searchlights of the brain; the power of observation should be cultivated in the young; it should continue through life. The observant man is the one clinging at the top of the ladder. He is there perforce; the bottom rungs give him too limited a view. Had James Watts not observed the steam raising the lid of his mother's tea kettle, or Isaac Newton noticed the apple falling to the ground, or Benjamin Franklin the electric current drawn by means of a kite string from the clouds, the world might yet be groping in the old paths of but three generations ago. This faculty of observation is becoming more recognized. The step from the circus poster to the elegant trade catalogues produced in such profusion nowadays, from the glare of the gasoline torch of the village fakir to the electrical illumination of a World's Fair, from the A B C book of our childhood with its large capital letter and accompanying illustration to the modern up-to-date trade paper gotten out with a range of literature and art that even the best of readers can hardly keep pace with, are all purveyors to this faculty of observation. This, then, can be termed the initial stepping-stone. Secondly, there is the use of this acquired knowledge. It must not lie dormant. As with everything else in nature, it must grow. The use of the fulcrum gives place to the hydraulic jack; the sledge and chisel to the pneumatic drill; and even a Simplon tunnel or an underground railway is a possibility; the turning by hand of a few teeth scratching on a circular disk of glass to a ten thousand horse-power dynamo, the sailing of the first small steamship across the Atlantic (built in the City of Quebec) to the mighty leviathians that now plough the deep: all proclaim this marvellous growth.

Wherein then lies the secret of all this wonderful advancement? Firstly, we have considered the power of observation; secondly, its use and growth; and now its practical application to

Aristocrat of the Work Bench.

every-day life, say of the machinist or engineer.

Underlying all that has already been said, one has to have an earnest and strenuous desire to succeed in the vocation he has adopted—nay, even more than this—the determination to make his immediate surroundings all conduce to this advancement. The world makes room for the determined man, the crowds draw aside to let him pass. To this ambition and determination he adds his powers of observation, the faculties of his mind expand and the knowledge of "knowing how" is a natural result.

In this category of powers of observation let us include in the case of the machinist and engineer, firstly, the reading of the trade paper. There is every hope for the advancement of those who keep in touch with what the world is doing at large through the columns of Canadian Machinery and kindred journals. Secondly, the observant eye to all that appertains to the improvement of his handiwork and the use of up-to-date tools now so readily obtained through illustrated catalogues, etc. Thirdly, availing himself of the opportunity to visit other workshops, or power plants; to visit local or World's Fair exhibitions, wherein are grouped together an array of talent that could nowhere else be seen.

There is no doubt in the mind of the careful student of the world's advancement that the nations which are to be world powers, to take the first rank, are those with well-trained, intelligent, thinking and reasoning workmen and artisans. The deficient in education will perforce be relegated to the rear, and as nations are the aggregation of families and families of individuals, "so power will flow to the man who knows how," and from him to the nation at large. Let us hope that we Canadians will not fail to grasp this before it is too late.

And before leaving this subject let us say, all honor to those who have so generously subscribed to the cause of education in this province and elsewhere in this Dominion. The culmination of this is, the creation of a superior class of workmen who may rightly be termed the "aristocracy of the workbench."

The Niles-Bement-Pond Co. have leased an entire floor in the new Trinity Building at 111 Broadway, New York, and will be located there after May 1. As is well known, the executive offices have been located in New York since the organization of the company under its present title. The Niles-Bement-Pond Co. employ about 5,000 workmen, and have two factories in Philadelphia, one in Hamilton, Ohio, one in Plainfield, New Jersey, and it also owns the Pratt & Whitney Co., at Hartford, Connecticut, thus constituting this company very much the largest builder of iron-working machinery in the world.

Manufacture of Bronze Statuary

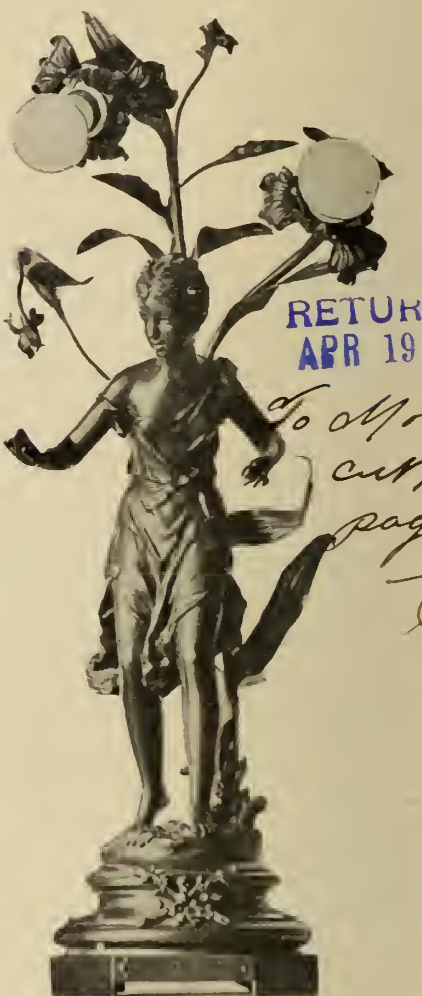
By J. A. Burns

NOT so many years ago, it was impossible for dealers to handle and sell in even fairly large quantities bronze statuary of the better class, the simple reason being that prices were too high, and those who had cultivated tastes for bric-a-brac and ornamental decoration of this sort could only be found here and there. Rapidly, however, during the past few years, this state of things has disappeared. With the advent of railways, and new

Bronze Figure—Munderloh & Co.

commercial conditions, the Canadian public began to spend more money on the decoration of their houses. Many French, Austrian and Belgian bronzes being imported, and the trade rapidly developing. By long odds, the French bronzes are ahead of those manufactured anywhere in the world. The Austrians made comparatively nice goods, but without the artistic sense and finish of the French. Most of the Austrian bronzes have simply an electro-plated finish, without having in any way the soft, delicate tones and harmonious colorings of the French artist. The Austrians, Belgians and Germans have tried time and again to produce this particular chef d'oeuvre of the French artisan, but without, so far, approaching them. Of course a medium is struck between the proverbial French goods and the better German goods, but for the highest class of work in this line, France excels those of every other country. American artists have within the past few years followed closely upon the heels of Austria, and have even produced much better work, and more closely approaching the French than any other nation. They are still, however, far behind the high-class French manufacturer of this line of goods.

It may be interesting to know how these goods are made: To commence with, the artist must first have his model. These models are obtained sometimes at great cost, by reproducing in smaller sizes the work of ancient sculptors, although in the past few years, owing to the increased demand for bronzes which can be arranged for artistic electrical illumination, the work of many of the modern sculptors has been utilized, and reproductions in smaller sizes of these can be seen in thousands all over France particularly. The work of the French sculptors has a careless grace to it approached by few others. In many cases, where the old figures were very beautiful, but not adapted to electric illumination, the poses have been changed slightly, so as to keep intact as much as possible the careless grace embodied in the original model. When these smaller reproductions are made, moulds then have to be constructed, and the great cost in the general bronze statue lies in the difficulty of casting these complete figures, which, of course, are very hard to draw from the sand; in fact, in many cases it is impossible, and the figures have, therefore, to be cast in pieces, and joined by brazing where the figure is to be in genuine bronze, and by a process known as "burning" the metal together, where it is only an imitation of bronze. In the genuine bronze figure, after they are assembled, they are passed to the hands of the ordinary workman, who does the roughing-down process, by filing and finishing with emery cloth, etc. The figures are then passed to higher-class artisans, who do the finer finishing, retouching and chasing, producing an almost life-like effect on the hard, solid bronze. These figures are now ready for the finishing process. They are, first of all, put bodily into an electroplating bath, thereby assuming a uniform bronze color, which is quickly rubbed down with very fine sand, and ready for the last, or coloring process which, in a few cases, has again an electro or chemical action, to produce the darker effect seen on finished bronzes; but, in most cases, the finishing is done by a special painting process, and herein lies the trouble experienced by nearly all the other nations who attempt in any



Bronze Figure—Munderloh & Co.

way to manufacture bronze figures, for they simply cannot attain the smooth-finished effects of the French.

After the bronzes are thoroughly baked, and have received two or three coats of coloring, they are then almost indestructible, and will preserve these effects for years. The beautiful, smooth finishes seen on the French bronzes are produced with a special kind of wax, rubbed in with a hard brush

Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

THE EVOLUTION OF ELECTRIC TRACTION.

To Thomas Davenport, blacksmith, of Brandon, Vt., belongs the honor of making the first recorded experiment in electric traction, for in 1834 he showed, at Springfield, and again in Boston, a toy model, mounted on wheels, and propelled a few feet on a circular railway by the current from a primary battery. This was but one of his accomplishments, for history relates that in a few years he constructed and put into operation no less than a hundred motors of a type now, of course, obsolete.

Four years later Robert Davidson, of Aberdeen, constructed an electric locomotive, which was tried on the Edinburgh-Glasgow Railway. In 1847 Moses G. Farmer, one of the most prolific of early experimenters, exhibited a small electric model at Dover, N.H., and three years later, in Boston, Thomas Hall showed an automatically reversing motor. The next year Prof. Page, of the Smithsonian Institute, with Congressional help, equipped and ran an electric car on a road near Washington.

Important Discoveries.

All these and various other experiments of those early years depended on the use of primary batteries, and hence, irrespective of the shortcomings of the machines themselves, commercial success was impossible. It was not until the invention by Pacinotti, in 1861, of the continuous-current dynamo, improved and developed by Siemens, Whitestone, Varley, Rowland, and others, and the discovery of the reversible functions of the dynamo-electric machine, said to have been made originally by Pacinotti in 1867, but certainly proved, some say, at first by accident, by Gramme and Fontaine in 1873, that the key to the electrical transmission of energy was found.

The First Electric Roads.

Between this date and the beginning of experimental work on modern lines, I find a mention of but one name, that of George Greene, a poor mechanic in Kalamazoo, Mich., who built a model car operated from a battery current passing through the track and an overhead wire.

About four years later three inventors, whose names are known the world over, became almost simultaneously and independently interested in electric railways. These were Dr. Werner Siemens, Stephen D. Field, and Thomas A. Edison. To Dr. Siemens belongs the credit of actually operating from a dynamo the first road for carrying passengers. This was accomplished at the Berlin Exposition in 1879. A toy-like affair it was—a miniature locomotive pulling three small cars, which seated about twenty passengers.

In 1879 Field filed a caveat, showing an electric railway taking current from a wire inclosed in a slot, and in 1881 made experiments in Stockbridge, Mass. In 1880, Edison, utilizing one of his old "Z" lighting dynamos, constructed and operated a small road in the yard of his laboratory at Menlo Park, using the two rails as conductors.

Early Experimenters.

About this time various other inventors began to take up the study of the subject, and Jenkins, Ayrton and Perry began the development of telferage or automobile railways. Chance is often responsible for inventions, and perhaps for my own entry into the railway field, for, although I had become interested as early as 1879 in the possibilities of a somewhat eccentric motor, it was not until 1882, when my duties as a member of a jury at the Crystal Palace, Sydenham, London, took me on the underground railroad, that I seriously considered this special problem.

In the year 1883 Field and Edison combined forces and exhibited at the Chicago Railway Exhibition a locomotive, called the Judge, which ran around the gallery, the motor used being a Weston electric dynamo. Siemens also installed the first line in Great Britain—that at Portrush, Ireland, and another short line was installed at Brighton by Magnus Volk. Charles J. Van Depoele, a woodcarver by trade, but an electrician at heart, and an indefatigable worker, began experiments at his factory in Chicago, using a 5-light dynamo on a car platform, and taking current from a wire laid in a slotted plank. He followed this by the installation of a short line at the Industrial Exhibition.

It was also in 1883 that that vetran of early struggles, Leo Daft, began his labors in Greenville, N.J., following them that Fall with the operation of the Ampere at Saratoga, and soon after with small roads elsewhere. Bently and Knight began their experiments in the yards of the Brush Electric Co., and in the following year they established a short conduit line in Cleveland, which was spasmodically operated during that Winter. At this time Van Depoele operated a road in the Toronto Exhibition, and Anthony Reckensaum, a particularly able engineer, actively conducted storage-battery work abroad.

The year 1885 was prolific. Daft began operations in Baltimore on the Hampden branch of the Union Passenger Railway with two locomotives, this being, I think, the first regularly operated electric railroad in the country.

Meanwhile Van Depoele had begun operations at South Bend and Minneapolis, Henry had installed a small line in Kansas City, and Short had embarked on experiments with a series system at Denver. That year and the next two years saw active work by all of us who had ventured in this new field, some with central station power and others with storage battery supply. Van Depoele and Daft were responsible for the principal roads actually installed at this time.

Active Progress.

The years between 1888 and 1898 were marked by continued and vital improvements in electrical apparatus and equipments, among which must be specially mentioned the introduction of the carbon brush of Van Depoele, the Thomson magnetic blow-out by Potter, form-wound armatures by Eickemeyer, and the combination of resistance and series parallel control, which was originally proposed by Hopkinson in 1880. Cast iron gave way to steel, two-pole motors to four-pole, self-open motors to closed and self-protected, and the single gear again resumed sway. The single trolley retained first place, as it still does, when we consider simplicity, effectiveness and minimum first cost.

Train operation, as distinguished from that of railway cars, began on the South London Railway in 1890, and this was followed by various proposals for the New York Elevated Railroad, the installation of the Intramural road at the World's Fair, Chicago, the equipment of the Lake Street Elevated Railway, and by other installations. Heavy electric locomotives were built in 1892 and 1893, both for experimental

work and for regular operation in the Baltimore & Ohio tunnel.

Alternating Current.

Meanwhile the limitations of direct-current motor work were greatly extended by developments in polyphase transmission, and the transformation of alternating current into direct current at a lower pressure by static and rotary transformers, through the work of Tesla, Stanley, Scott and others. The first actual proposal to use this combination was made in 1896 by Mr. Arnold, past president of the American Institute of Electrical Engineers, and it has now become standard practice. One immediate result of this was the rapid introduction of comparatively long-distance, high-speed, inter-urban electric railway lines, which, although generally operating single cars, have exerted a great influence upon steam railways and been instrumental in welding together urban and rural communities.

Recent Developments.

But with all these advances, train operation was still limited, and largely because of adherence to old-fashioned locomotive practice. Having been for a long time engaged in developing the indirect control of elevators, the thought suddenly flashed upon me that trains could be better operated by simultaneously operating a number of controllers, each with its own motors, thus allowing any desired aggregation of independent units in a train having all the characteristics of the individual.

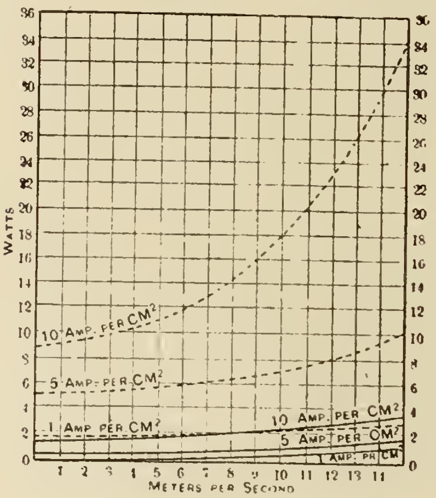
Up to the present time almost all important work has been conducted with continuous-current motors at moderate potentials, but on any large system this requires the transmission of energy from a long- distance by high-pressure alternating current, and reduction to a lower pressure and transformation at sub-stations.

To economically extend the radius of electric operation from these sub-stations it is, of course, essential to work at . comparatively high pressure. In order to attain this end without running into serious or assumed difficulties with continuous-current motors, as well as to get rid of the moving element in sub-stations, the activities of leading engineers, among whom must be mentioned Tesla, Finzi, Lamme, Eichberg, and Steinmetz have for some time been on the development of the alternating-current motor. The earlier attempts in this direction were for a machine without a commutator, that is, one that could be operated by polyphase currents, and it is on these lines that the admirable work of the Ganz Co., and the high-speed tests on the Zossen military line in Germany have been carried out.

But the recent developments, in America at least, have been almost entirely along lines of single-phase operation, in order to maintain the simplicity of the present trolley line practice. A large measure of success has already been attained in this direction, so much so that the single-phase motor can now be accepted as an essential contribution to railway operation, its adoption being a matter of individual determination. In this connection I should add that Mr. Arnold was one of the earliest, and has been one of the most consistent, advocates of single-phase operation—Frank J. Sprague, American Ins. E. E.

MATERIAL FOR BRUSHES.

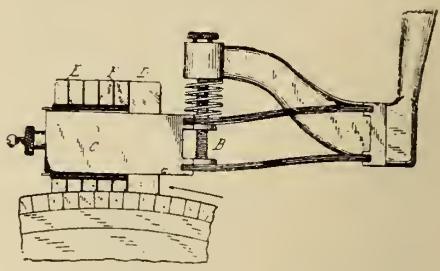
A SWEDISH firm has placed on the market a new type of dynamo brushes called bronze-carbon brushes. The grains of pure powdered graphite are first plated with a coat of copper and then with a coat of tin, the method not being described. The powder is then formed into brushes by a hydraulic press under very high pressure, without using any binding material. By varying the pressure the hardness of the brushes can be adjusted at will. The brushes are then heated, whereby the tin alloys with the copper and forms bronze, so that each little particle of graphite is now coated with a bronze film. Fig. 1 shows the energy consumption by bronze-carbon brushes (drawn out curves) and good, ordinary carbon brushes (dotted curves) for different current densities and different speeds. The abscissae represent the commutator speed in meters per second, while the ordinates represent watts. For instance, the energy loss at a current density of 10 amp. per sq. cm. at a speed of 15 meters per second is 34 watts with carbon brushes and 3.4 watts with bronze-carbon brushes. The wear and tear of the bronze-carbon brushes is a little greater than that of all-metal brushes, but the wear and tear of the commutator is smaller.—Elec. Zeit.



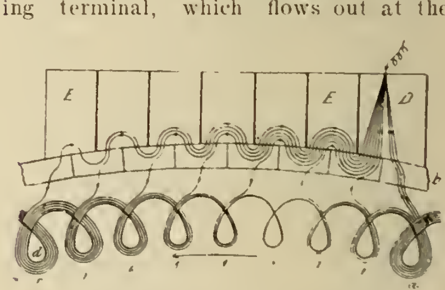
Energy Consumption by Brushes.

COMMUTATION OF DIRECT CURRENT MACHINES.

TWO patents issued to Mr. F. M. Young, and two to Mr. G. S. Dunn, all four being assigned to the Crocker-Wheeler Co., have for their common object to improve the present method of commutation in direct-current machines by increasing the resistance in the path of the current from the live brush into the advancing terminal of the commutating coil without increasing the resistance between the live brush and the trailing terminal of the commutating coil, the object being to accelerate the reversal of the current in the coil. For this purpose the inventors use auxiliary "dead" brushes, which are insulated not only from the live brush and its holder, but from every other part of the machine, so that they are completely dead except for their contact with the commutator bars. In the accompanying illustration D is the live brush, while the dead brushes are represented by E, the insulation surrounding each of the dead brushes being indicated by the letter F.


End View of Brushes.

Referring to cut, coil A is receiving current from its left-hand or leading terminal, which flows out at the right-hand or trailing terminal and into the coils to the right. When the coil A reaches the position of coil 1, it is short-circuited through the live brush, but owing to the inductance current continues to flow in the same direction as before, although of a diminished value. When the coil A reaches position 2, it is short-circuited through a dead brush, and current tends to flow from the live brush in at the trailing



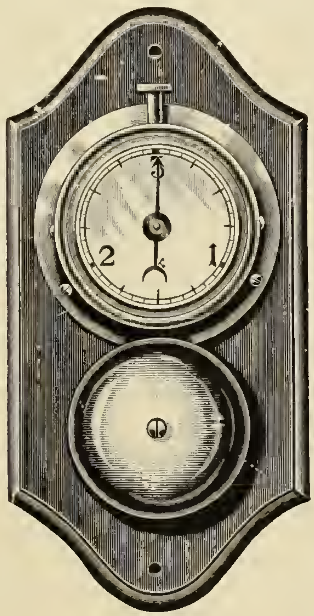
Commutation of Current in Coil.

terminal; but this, which would effect a reversal of the current in the coil, is opposed by the self-induction thereof.

Current also tends to flow from the live brush and in at the leading terminal; but this is opposed by the two additional surface contacts between the commutator bar and the first dead brush, and this brush and the next commutator bar. As the coil A moves to the left the facility for receiving cursively diminished because of the increasing number of contact surfaces through which such current has to pass. On the other hand, the facility for receiving current at the trailing terminal from the coils to the right is not diminished, and, therefore, the tendency is for the current in the coil to be reversed gradually. As seen in cut, the planes of separation between the brushes are inclined relatively to the strips of mica on the commutator for the purpose of preventing an instant of absolute rupture of the commutating current when the trailing side of the live brush leaves the commutator bar, thereby avoiding any sparking at the brushes or burning of the commutator bars. An effect to be noted due to this method of commutation is that not only into the advancing terminal of one, but into the advancing terminals of a number of successive coils, a gradually-increasing resistance is introduced in such a way that at each terminal a resistance of different amount to that at any other terminal is produced at a given time, forming as many paths of current as there are different resistances. — El. World and Eng.

HEATING A TOWN BY ELECTRICITY.

DAVOS, a town in the Swiss Alps, is unique on account of the fact that it is heated entirely by electricity. It is famous for its dry, healthful climate, and in the Winter season thousands of tourists and health-seekers sojourn there. It is situated at a high altitude, so that its Winters are cold, but dry and invigorating, and its air so pure that two great sanitariums are occupied by people in search of health and recreation, or both. The question of heating the town of Davos and its two important sanitariums vexed the local authorities for many years. The fear of contaminating the pure, dry air of the mountain resort with smoke and ashes finally led them to adopt electricity for all purposes—heating, cooking, lighting and power. There is a fixed population of about 3,000 to-day, and a visiting population of nearly as many more. The question of the best form of heat for the sanitarium patients was also considered from a medical point of view. The physicians condemned gas and coal stoves on account of the unhealthy odors emitted by them, and steam heat for the houses and hotels was considered unhealthful also. Electricity was finally adopted as the best for all concerned, provided that it could be obtained at a reasonable cost. The electricity for heating the town is supplied from power-houses on the two streams, Landwasser and Albula, situated nearly ten miles away, where there is a fall of nearly 1,300 feet. There is sufficient water-power on these two streams to heat and light the whole town, and the final completion of the plant has enabled every inhabitant to use electricity for every household necessity. The town covers a district about two miles long and half a mile wide. In this space the large hotels and sanitariums are grouped. — American erican Electrician.



Telephone Clock

NEW COMPOUND FORMED IN ELECTRICAL FURNACE.

A NEW compound, the boride of manganese, has been recently formed in the electric furnace by M. Binet de Jassoneix, of Paris. The method of obtaining this body is described in a paper read before the Academie des Sciences. Amorphous boron reduces a considerable number of metallic oxides. With the oxides of iron, nickel, and cobalt it gives a metallic mass from which crystallized borides of these metals can be separated, as M. Moissan has already shown. Troost and Hautefeuille have prepared a boride of manganese, $Mn\ B_2$, containing 28 per cent. of boron. The oxides of manganese are reduced by boron in an air furnace, but it is difficult to obtain a metallic mass. In the electric furnace where the temperature is higher, the boric acid which is formed is volatilized, and a melted mass containing boron and manganese is formed. The present experiments were carried out by placing a carbon trough in the furnace, containing a compressed mixture of oxide of manganese and boron. This is reduced in a few seconds. When the manganese is in excess, the metallic mass may contain 97 per cent. of the latter, and takes the file easily. With an excess of boron, on the contrary, we obtain a hard and granular mass containing some 20 per cent. of boron. These metallic masses are attacked by acids and burn with incandescence in chlorine, but the action stops at once in the latter case and the melted chloride of manganese protects the residue from further action. This residue contains the new compound, boride of manganese, which is separated by washing with water and alcohol. It is a brilliant metallic powder, formed of small broken crystals. Its density is 6.2 at 15 deg. C. In fluorine gas it burns with a flame, and in chlorine with incandescence. When heated in oxygen it glows brightly and forms a fusible borate. It is attacked slowly by cold water, giving off hydrogen and forming manganic hydrate. Hydrochloric acid dissolves it, and forms a gas which burns with a green flame. The author analyzed the compound, and finds that it corresponds to the formula Mn B. It is to be placed in the series of definite and crystalline borides of iron, nickel, and cobalt which M. Moissan has already formed.—Scientific American.

Telephone Clock.

A NEW device which has been placed on the market is an electric telephone clock. As will be noticed by the accompanying illustration the clock with an alarm is mounted on a piece of wood, which in turn is supposed to be placed near the telephone. Although practically a new article it has been found to be of great value by users of the long distance telephone. The mechanism is simple. All that is necessary is to press the pin above the figure 3, which winds the clock. It will then run for three minutes and at the expiration of this time the alarm will sound thereby giving the speaker an idea of what length of time he has been using the telephone. This device should be readily appreciated by these people, as it will materially help to check the charges of the telephone company. It is guaranteed to be perfectly accurate and will stand the strain for scores of years.

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

SPECIALIZED MACHINE TOOLS.

ALTHOUGH the present is an age of growing specialization it is a generally recognized fact that its realization is not always apparent among machine tool builders who do not themselves specialize. The new types of machines are somewhat scattered and rather belittled among the overwhelmingly large numbers of those built after general types by which they are surrounded. Neither are the features which give them a special character always obvious. Some attention may, therefore, be profitably devoted to this subject. Its importance becomes greater from year to year.

At one time there were only two tools in an engineer's, or rather a millwright's, shop—the lathe and the drill press. There were no planers, or shapers, or slotters, no gear-cutting, milling or grinding machines, no boring machines, no screw machines of any kind, no automatic movements, no machines for flanging or rolling, no power hammers, no moulding machines or power cranes, nothing, in short, except the old lathe of skeleton design and the drill press, such as you may still see in country blacksmith shops.

Regarded from this point of view, every modern machine in its first inception was a special tool; but since they are now common, do not rank as such; and the term special is restricted to those smaller groups of tools which are designed for repeated operations of a single character. Thus, one might reckon up about forty distinct classes or groups of lathes, but comparatively few of these are of a strictly special character. Planers, boring machines, drills, and others occur in numerous groups or subdivisions; but most are designed for one great class of general work, and a few only for a particular kind of job, which is the distinction we must observe.

At present the struggle between the general and the special is so severe that a great number of machines are designed to combine the two conditions, such as machines made primarily for the performance of certain functions on the same kind of work, but with adjuncts of which the object is to extend the range of their utility into general practice. Some of these are of eminent value; others cannot be regarded as successful solutions of the problem. In many cases it is not practicable to unite the two sets of requirements in one tool, and when the special is sacrificed in any important degree to the general a mistake is usually made. The exceptions are in those departments where the general work predominates, in which case a special rig-up meets the case.

As a single illustration bearing on this point, take the case of boring. This was originally done in the lathe, or on the drilling machine, the latter being used for the smaller holes, or for work that could not be put in the lathe, and the former for the larger work. It is often done so to-day. In no sense are these makeshift methods when occasional jobs only are in question. But if the work is largely the boring of bearings in cheeks or side frames, it is better to rig up a templet with fixed holes and bore through that, and so avoid separate markings-out and settings. If cylinders are constantly to be bored, then the lathe is not so handy or economical as the boring machine, in which precise adjustment for height is effected by a rising table, thus avoiding the use of the packings necessary on the lathe saddle.

A phase of workshop practice which is intimately related to this one of special machine tools is that of jigs and templet making—related because the one is both the precursor and the successor of the other. Jigs and templets are used to specialize in the work of the general machine. Thus, a drilling templet, more or less elaborate, is made to fix the centres of holes to be produced by a common drilling machine. It would not pay to make such a templet for a few pieces of similar work. Neither would it pay to drill a large number of pieces without an aid of this kind. Just when its expense is justifiable or necessary is a matter of judgment, and of estimating relative cost as well as of uniformity and accuracy of results. Such a templet may in some cases be made most elaborately, completely encasing its work, and containing provision for facing, tapping, counterboring, etc., in which case it is generally termed a jig.

There is not much hesitation as to the policy of constructing a highly specialized machine, unless for any other kind of work than that for which it is designed, when the dimensions and weight are moderate and the details not very intricate. But when it becomes very massive and intricate, the policy requires very careful consideration. Hence, the big, very special machines and the complicated, smaller ones are confined to comparatively few shops.

Every new industry of magnitude gives birth to new designs of machines. First, manufacturers try to get along with the old ones, making jigs and templets, and generally following the old methods. Then modifications are made in details, giving elementary forms of combination machines, and at last new designs are evolved, in which makeshifts are wholly abandoned in favor of mechanisms designed for the performance of only one class of work. There must, of course, be a sufficient volume of work to pay for new machinery; but, given that condition, there seems no limit in reason to the developments that may arise from a new industry.

We have seen these changes during recent years in armor plate manufacture, in the supersession of iron by steel, in the cycle trade, and in the electrical motor-car industries, each of which is responsible for a number of new tools. Some of these in a short time become appropriated by the general engineer, and another generation will not be aware of the source of their evolution.

A result of these changes is that the manufacture of machine tools has become highly specialized. Though but one department of engineers' work, it is now cut up into a number of distinct industries. Already some of those subdivisions are also being broken up. Lathes of all kinds, for example, are no longer made by one firm. Those who make turret lathes seldom make wheel lathes or axle lathes. Vertical lathes are a sole specialty in the business of some few firms. Spinning lathes are generally the product of those who manufacture machines for sheet-metal workers. Copying lathes form a department of woodworking machinery. This last-named industry is one that stands quite apart from general engineering, as it does from machine-tool making. Yet several hundred firms are engaged regularly in this line. Metal-planing machines are taken in hand by a few firms, portable machines by others, and a large number of other examples of specialization in tool manufacture might be instanced.—Cassiers' Magazine.

BRITISH MILLING PRACTICE.

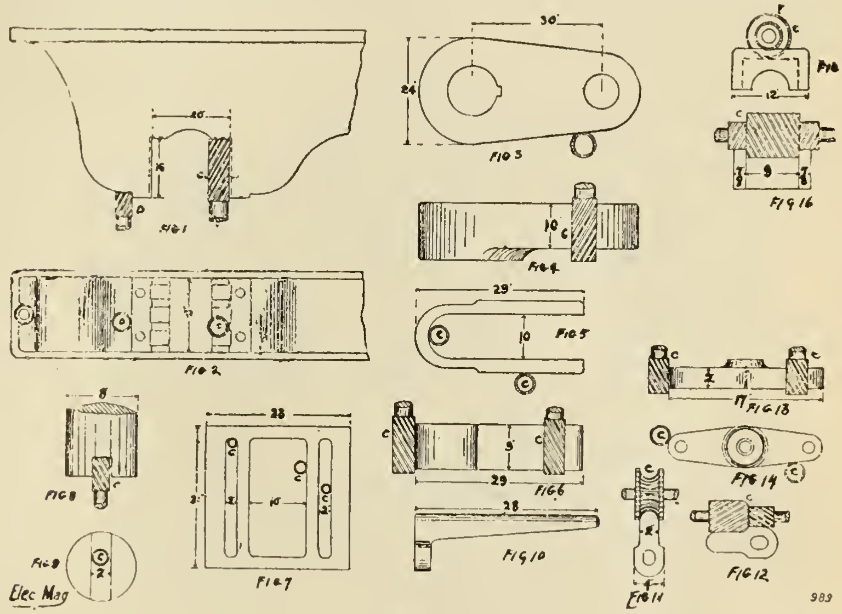
SEEING that the milling machine has taken such an important part in increasing the output of the modern machine shop during the last few years, a few examples of up-to-date practice, as carried out by some of our leading English builders of heavy slow-speed engines, may be of interest to the majority of readers. In almost every case millers affect a considerable saving of time and money, compared with the older methods, and without any special appliances being needed beyond the regular cutters which can be used on a variety of work.

Fig. 1 shows in elevation the pedestal end of a large Corliss engine trunk hed. The main crank shaft bearing is of the adjustable type, and the chipping strips down each side, and across the bottom for a distance of $4\frac{1}{2}$ in. on each side, require to he accurately machined, as also does the top surface for the pedestal cap. This operation was formerly a very slow process and usually a lot of hand chipping had to he done. It is now done on a large miller of the horizontal spindle type with a great saving of time and labor. The bed is bolted up against two large angle plates cramped on the floor plate, and a large cutter C, 18 in. long and 7 in. diameter, operates on each side and across the hottom hy the vertical feed. This makes a very satisfactory job at a cutting speed of 30 ft. per minute, with a cut 5-16 in. deep and a feed of $1\frac{7}{8}$ in. for roughing, whilst for finishing, the speed is increased to 45 ft. with a feed of $2\frac{1}{2}$ in. with a cut 1-16 in. deep. The short stiff cutter D is $6\frac{1}{2}$ in. diameter and 8 in. long, and is used for milling across the top, and along the edges for the cap as shown, the vertical feed also being used for this operation. Fig. 2 shows the same joh in plan.

Fig. 3 shows the plan and Fig. 4 the elevation of a large forged steel crank. This is machined to shape round the edges, as shown, on a large vertical spindle slah miller or plano-miller, the straight sides heing done first, the two ends then heing finished on the circular milling attachment mounted on the tahle. The cutter C is 16 in. long and $7\frac{1}{2}$ in. diameter, and with a roughing cut $\frac{3}{4}$ in. deep and a feed of $1\frac{1}{4}$ in. running at 35 ft. per minute, with a good supply of lubricant for cooling the cutter. For finishing, the speed is increased up to 50 ft. per minute, with a feed of $2\frac{1}{4}$ in. per minute and a cut 1-16 in-deep. These cranks when slotted took a fitter twenty-one hours each to file up and polish. The milling cutter with luhricant leaves a fine finish and the joh now takes eight hours each, only to polish up.

Figs. 5 and 6 show the plan and elevation of a large steel strap for the connecting rod. This is machined all round both inside and outside on the vertical spindle miller. The cutter is shown at C and runs at a peripheral speed of 35 ft. per minute, and a feed of $1\frac{1}{4}$ in. per minute for roughing. When finishing, the speed is increased up to 50 ft. per minute with a feed of 2 in. per minute. These straps formerly took twenty-five hours each to slot, but we now mill them in sixteen hours each, and also save a large amount of time in filing up and polishing, the milling cutter leaving a much smoother surface than the slotting tool.

Fig. 7 shows the plan of a large slide-valve arranged for cut-off valves to work on the hlack face. On this the edges of the steam and exhaust ports require to he straight, and we used to



British Milling Practice.

slot and chip round the ends, taking about twenty-five hours each to complete the two faces, back and front. We now make a more satisfactory job of them, by milling on a vertical spindle milling machine with a cutter $1\frac{1}{2}$ in. diameter, running at a peripheral speed of 26 ft. per minute, with a feed of $1\frac{1}{4}$ in., depth of cut $\frac{1}{8}$ in. Once round is sufficient to make a smooth surface, and the time taken to complete one valve was nine hours without any chipping.

Fig. 8 shows the plan and Fig. 9 the end view of a Corliss valve, front end cored for the spindle. These formerly took $4\frac{3}{4}$ hours each on the slotting machine, hut we can now mill them on a horizontal spindle miller, using the vertical feed with the end and side milling cutter shown at C. They are now completed in $1\frac{3}{4}$ hours each, the slot being parallel and requiring no filing.

Figs 10, 11 and 12 show a large cutter, forged steel, for the strap end and large connecting rod, machined all over in a Lincoln pattern milling machine hy cheap labor. Fig. 11 shows the concave cutter, C, milling the convex edge of the cutter, the opposite flat edge being milled to the requisite taper by an ordinary flat cutter, and the large convex end hy a concave cutter of the same radius. These were formerly done on planing and shaping machines, and were a very unsatisfactory job, a large amount of hand chipping and filing having to be done round the large end.

Figs. 13 and 14 show the elevation and plan of a forged steel cross-bar for a stop valve machined all round. When slotted these took nine hours each, but we now mill them on a vertical spindle miller in two hours each, and put a good finish on them. The straight sides are done first, the ends being done afterwards hy the circular motion. The cutter is shown at C and runs at 45 ft. per minute with a feed of $1\frac{1}{4}$ in.

Figs. 15 and 16 show the end and side elevation of a large brass step for a connecting rod end. These we mill to size by "ganging" the cutters as shown at C, thus making them the correct width for the strap without much filing; peripheral speed of large cutter 80 ft. per minute with a feed of $2\frac{1}{2}$ in.—Electrical Magazine.

VIBRATION IN MACHINERY.

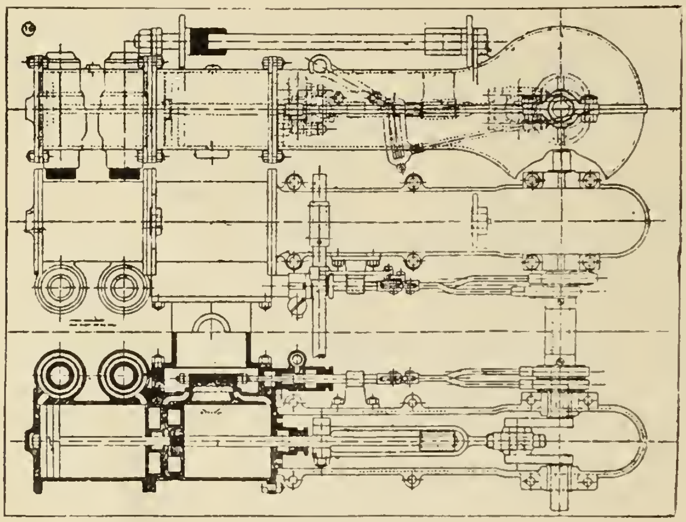
HIGH-SPEED engines and machines have some distinctive troubles of their own which are not at all common to their more leisurely brethren, one of these being that of vibration. The following experiences may be found interesting as showing the effects of an unhalanced mass when rotating at a high rate of speed, and the

means employed to overcome these undesirable effects.

The first case was that of a disk grinder. This machine was of a well-known make, having an 18-inch steel disk affixed to each end of the shaft, which was supported by a journal at each end, the driving pulley being in the centre. Rings of emery cloth formed the grinding medium, these being affixed to the steel disks by means of glue, a coarse grade of emery being used on one disk and a finer grade on the other. The machine was rigid and of heavy design and ran satisfactorily for a considerable time; but, as the emery sheets were being rapidly used up—due partly to the carelessness of the apprentices in grinding small articles and using undue pressure on the wheel, which soon tore up the surface of the cloth—the management decided to replace the sheet on which the rough grinding was done by an emery wheel $\frac{3}{4}$ inch thick and of the same diameter as the steel disk.

After some consideration it was decided to try whether the spindle and disks were balanced; this was done by taking the spindle out of its journals and placing it on two straight-edges which were set parallel to each other and perfectly level. By this arrangement the spindle was allowed to turn with a minimum of friction, thus allowing any want of balance to be observed. It was at once seen that there was a heavy side on one of the wheels, so the spindle was replaced in its journals and the steel disks were tried to see if they were running true; these were found to be all right, but it was noticed that the emery ring was slightly out of true on the face and edge.

The machine was started up at a slightly less speed than when working and the emery ring trued up by means of an emery wheel dresser, the lower speed being used to get rid of the vibration. When the wheel had been trued and the machine was run at full



Svea Caloric Engine.

The ring was affixed to the steel disk in the same manner as the emery sheets, and gave excellent results for some time; but the machine soon commenced to vibrate very badly, so much so in fact that it was extremely difficult to grind a piece of work on the machine, due to its tendency to travel all over the table. As this state of affairs could not be allowed to continue, an investigation of the machine was made. On examining the journals it was found that the one next the ring was slightly worn and that the shaft had about $\frac{1}{4}$ inch end play. Nothing else being found to account for the vibration, the journal was adjusted and a ring placed on the spindle to take up the end play. The machine was then started, but it was found that though the vibration was reduced it was still there, and that if the machine was allowed to run it would soon be as bad as before.

speed, it was found that the vibration had disappeared and that the machine ran as smoothly as before; the heavy side on the emery ring, due to uneven wear, had been the cause of all the trouble.—American Machinist.

THE SVEA CALORIC ENGINE.

COOL air, split up into limited portions, and rapidly heated by being forced over a hot surface, is the foundation of the system which has been adopted for the Svea engine. The engine is self-starting, double-acting, reversible, and is regulated like a steam engine, making 150 revolutions per minute. A six-horse-power Svea engine is now being built, applicable for laundries, automobiles, etc., and a 100-horse-power stationery engine is in preparation. The six-horse-power engine has two cylinders, with a diameter of four and one-quarter inches and a stroke of four and seven-eighth inches.

The heater is twenty inches in diameter, sixteen inches long, with a heating surface of sixty square feet. The engine and heater complete weigh 450 pounds. A one-half horse-power Ericsson engine, with a cylinder ten inches in diameter, weighs 1,700 pounds and makes seventy-five revolutions per minute. This is the handicap with which that type has been hampered, and which makes it an impossible proposition for even a few horse-power.

The Svea engine consists of a power cylinder and an air pump. The cool air is drawn in from the atmosphere for small sizes and pumped into a heater, where it is forced over the heated surface well divided up, which causes it to rapidly absorb the heat. The air heated to a temperature of about 430 degrees centi-grade goes then into the power cylinder, where it does the work, and from there to the atmosphere.

The large stationery and marine type works with the air at a pressure of 100 pounds per square inch, using the same air over and over again, alternately heating and cooling it. The same system of heating it is, however, employed; no dependence being placed on the mere rising of the warm air into the cooler above.

The Svea engine does not expose a larger surface per horse-power than the steam engine, and the heater utilizes all the available heat as perfectly as any steam boiler. All conditions consequently being equal, the saving by the hot air engine would be the amount of heat required to vaporize the water, minus the heat recovered by condensation. One kilogramme of 100 degrees centi-grade water requires 537 thermal units in order to convert it to steam of the same temperature.

The heat recovered by condensation is:

$$\frac{10{,}334 \times 1{,}649}{424\left(\frac{10}{9}-1\right)}\left[1-\frac{(1{,}649)}{(14.55)}\right]=$$

76 units.

making a total net loss of 537-76, equal to 461 units, which clearly explains the reason why the best triple expansion steam engine only shows an efficiency of fourteen per cent.

The cylinder of the Svea engine does not require any cooling water, which is the cause of a very large loss in the gas engine.

The theoretical efficiency of the Svea engine with the air at 430 degrees is :

$$1-\frac{273+40}{273+430}=0.56=56 \text{ per cent.}$$

—Electrical Review.

CEMENT AS BUILDING MATERIAL.

By Robert Taggart, Toronto.

TO those who have been following the signs of the times it is evident that a gradual but distinct change is going on in the economic world, and in no department more noticeably than in building. That this is so may be assigned to two reasons: 1st, the increased cost of and difficulty in procuring the materials formerly largely used, and 2nd, the introduction of a material having unlimited quantities procurable and which can be used in all kinds of construction work. Lumber is becoming scarcer and more expensive, brick has doubled in price, and buildings of that class are restricted to the supply.

The introduction of cement into direct competition with brick as a building material has permitted the construction of works and buildings, which could not otherwise have been undertaken. Although cements have been used for ages, and many works and buildings are still in good condition which were constructed by the early Romans, yet the cement of to-day dates only from 1824, when the name "Portland Cement" was given to a material patented by one Joseph Aspdin, of Leeds, England, who gave it this name on account of its resemblance to the Portland rock of England. Many people, familiar with the name "Portland Cement," are under the impression that it is a product of American origin, taking its name from Portland, Maine; but, as a matter of fact, Portland cement of the very best grade is manufactured in immense quantities in Canada, and the supply is unlimited, so that it is not surprising to see the wonderful increase in the consumption of it in building and construction work.

Attention need only be directed to the extensive work now going on at Niagara Falls, or to the locks recently completed at Peterboro—the largest and finest work of the kind in the world, and built from the plans and under the supervision of a Canadian civil engineer, Mr. Rogers.

No single industry in Canada has made the rapid advance within recent years as that of cement, and its uses and advantages are only beginning to become known—new uses being found every day. Its use in sidewalks and foundations is well known; structural work, bridges, building blocks, shingles, fence posts, railroad ties, water tanks, silos, grain elevators and burial caskets are other industries grown up since the possibilities of cement are better understood.

Formerly it was thought necessary to build very heavy walls, but now, with below the ground line, where it sustains the earth pressure. Above the ground the side walls are only four inches thick. Also a concrete stand-pipe at Milford, Ohio, may be mentioned. This stand-pipe is 84 feet high and 14 feet in diameter, and, though it has to sustain an enormous water pressure, its wall is only 9 inches thick for the first 30 feet, 7 inches for the next 25 feet, and 5 inches in the upper portion.

Concrete Block Construction.

the latest system of steel reinforcement, greater strength and less weight are obtained. Mention might be made of a building now under construction in Cincinnati. This building will be 10 storeys high. The columns, girders, floors and walls are of reinforced concrete. The floor slabs, which are about 17 feet square between the columns, are only 6 inches thick, reinforced along the lower part with intersecting rods. There is a forty-foot basement, and what is worthy of special notice is that the retaining wall is only 6 inches in thickness

The use of cement as a material for dwellings is of more recent date, and much attention has been given of late to the making of cement and concrete blocks. Many and varied are the devices for turning out a block, and machines, from a square wooden box to the elaborate piece of mechanism intended to make all conceivable shaped blocks with one motion, are offered to the intending purchaser.

Houses built of concrete blocks may be made most artistic in appearance, and are strong, dry, and fireproof. No build-

ing material will stand up through a fire like the concrete. Many proofs of this are obtainable. The hollow blocks now so generally used, insure a dry, frost-proof wall, and much less time is required in the erection of a block building than with brick. There is no business that offers better opportunities for immediate development than concrete-block building, and with a machine to supply the requirements—not necessarily an expensive outfit—profitable contracts are now open, and a large field opening up in the towns and cities, as well as throughout the country, in building barn foundations and cisterns and silos, which are proving very satisfactory wherever in use.

In closing this article, I would quote the following extract from The Estherville (Iowa) Enterprise, of Jan. 11, 1905:

"In the fire which swept over this city a few nights ago, the Davis building, constructed of hollow concrete stone, was severely exposed to fire and water, but stood an impregnable barrier to the progress of the flames. There was a solid sheet of flame beating against the cement blocks composing the walls of the building, and then there would be a copious application of cold water from the nozzle. The blocks stood these extremes of temperature without any noticeable splitting or chipping of the blocks. The result is a surprise to many; several of the special agents of the insurance companies involved in this fire made a very close inspection of the Davis building in order that they might be able to make an intelligent report to their companies, and one of them, a representative of a London company, said that no ordinary brick wall would have withstood the alternate exposure to heat and cold that these cement blocks did. Another said that on ordinary-constructed cement-block buildings, insurance companies would be warranted in materially reducing the cost of insurance.

"The limestone trimming on the Coon block and the boulders in the foundation were badly split and broken up by the heat and water, while the cement blocks were not similarly affected. The inside of the wall of the Davis building was not in the least discolored by the heat, and no time was it so hot that one could not hold one's hand against it. The strength of the wall is obvious from the fact that the three-storey brick wall of the Coon building fell crushing against it without injurious effect."

A WOODLESS BUILDING.

Two Baltimore architects have drawn plans for a building entirely without wood. It will be six storeys, and will have a frontage of 41.5 feet. The entire structure is to be of reinforced concrete and steel. Even the doors, trims, window sashes and door jambs are to be of metal. The windows will be glazed with wire glass. The frame for the show windows will be of steel, into which the plate glass will be fitted. The side walls, columns and rear walls, as well as the supporting columns of the front walls, will be of concrete. The floors will all have a top-dressing of cement one and a half inches thick. The stairs will be of concrete, with slate treads and wrought-iron balustrades. The elevator shaft will be of concrete, as will also the enclosure around the stairway and the elevator hall. The cellar and roof are to be of cement. In order to eliminate all wood, even the flagstaffs on top will be of steel.

MAKING BRICKS WITHOUT CLAY.

An industry is about to be established in Toronto Junction which may have a very important bearing upon the building operations of the city in the near future. A company is being formed to manufacture what is called "silica brick" with the "Berg" press on the sand lime process. The brick is, in short, nothing but sand, with from 8 to 10 per cent. of lime mixed, pressed under heavy pressure, steamed over night, and is ready to put in a wall next day. The brick, which can be made from ordinary sand, is somewhat whitish in color.

A brick made from the sand pits at Toronto Junction has been tested at the School of Science and supports a pressure of 53 1-2 tons.

NEW METHOD OF LAYING CONCRETE.

An unusual concrete wall for a cylindrical water tank has recently been constructed by Mr. J. F. Lyman, of Modesto, Cal. The novelty lies in the method of carrying out the work. Within the forms for the outer and inner faces, collapsible cylindrical forms, of a diameter somewhat less than the thickness of the wall, were placed vertically at intervals. These were perforated with several holes, and were inserted for the drainage of the fresh concrete. The space between the outer forms was filled with concrete, which was given an over-night set, then the water which had collected within the cylindrical forms was drawn off and the space occupied by them filled with concrete. The hollow cylinders, it is stated, contained from 2 to 6 in. of clear water at the end of from 10 to 12 hours, that had drained into them from the concrete. The object in providing this extra drainage was to procure a more uniform set through the cross-section of the wall. A large number of concrete structures have been built in this manner, including the head gates, waste weirs, drops, and highway bridges on a large irrigation project. Concrete laid by this method is unusually uniform in strength, free from cracks and homogeneous in appearance.

AN INDUSTRIAL INCUBATOR.

Public-spirited citizens of Hartford, Conn., have started an interesting enterprise. About $115,000 have been subscribed for the purpose of erecting what has been termed an industrial incubator or nursery. In the building, which will be equipped with a power plant and will have a floor area of more than 50,000 square feet, it is proposed to let rooms and power at a nominal figure to infant industries and an inducement to new industries to go to the city or start there, the idea apparently being that the infants will soon develop into full-grown manufacturing undertakings beyond the capacity and needs of the nursery.

NEW BUILDING MATERIAL COMPANY.

Guelph is to have a new industry in operation by May 1st for the manufacture of cement and sand building brick. The company has lately been organized, and includes some of the most prominent business men of Guelph. It will be capitalized at $40,000. It is intended to produce large quantities of cement brick, and will control the exclusive right for the manufacture of this throughout Wellington, Peel, York and the City of Toronto by the process adopted by them. This new company is asking no bonus from the city. It is expected to manufacture 15,000 bricks per day.

Gas-engine power and single-phase traction are combined in an electric railway system being built to operate between Warren, Pa., and Jamestown, N. Y. The power station is being equipped with two 500-horse-power gas engines, of horizontal single-crank double-acting type, directly connected to two single-phase alternators supplying high voltage current for direct transmission—without raising transformers. A 55-horse-power gas engine is also provided for the exciter and the air compressor.

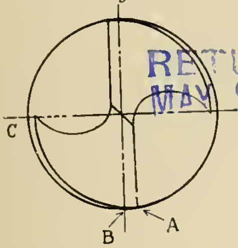
Twist Drills: Their Uses and Abuses.

THE advent of the now common twist drill marked a very important period in mechanical industry. It is, all things considered, the most efficient tool used by mechanics, for in no other tool is the cutting surface so large in proportion to the cross sectional area of the body or part which is its real support.

Comparative Efficiency.

By actual measurement of the cross section of the fluted part only 50 per cent. is left for effective work, yet a drill will bear more stress in proportion to its own strength than any other tool,

Fig. 1.



for the reason that it is supported by the metal upon which it is operating, and is thus prevented from springing away from its duty. This support is of two kinds: first, that due to the wedge-like action of the point, and second, that derived from the small amount of concentricity which the drill has just behind the cutting edges, see Fig. 1.

Diametrical Support.

The latter, however, is of little importance, as in a large number of cases only one side of the drill gives any support to the cutting edges, as will be shown in paragraph under grinding of points, page 13.

Cutting Edges Support Each Other.

The support given the drill in the instance first cited is of more importance, and arises from the tendency of either cutting edge to spring away from the cut, which in a correctly ground drill is, of course, counterbalanced by the opposite cutting edge having the same tendency, only in an opposite direction, so that with the feed pressure on the drill tending to force the cone-shaped point into a cone-shaped hole, the drill is held rigidly in a central position.

A twist drill is a tool generally formed by milling or forging in a cylindrical piece of tool steel two equal and opposite spiral grooves of such shape as to make suitable cutting edges on the cone-shaped end.

Fig. 3.

Fig. 4

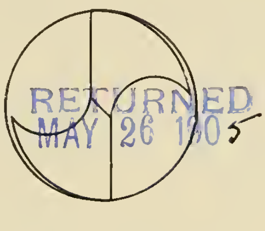
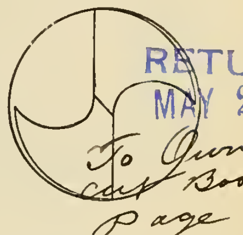


Fig. 5.



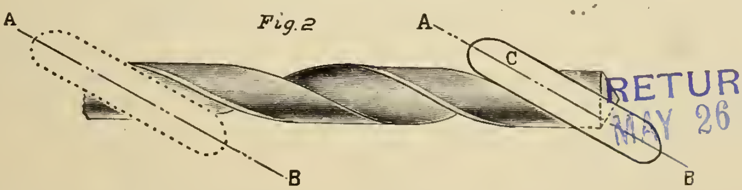
Longitudinal Clearance or Relief.

Drills are not of the same diameter from end to end, but decrease in diameter from the point towards the shank by an amount varying from .00025 to .0015 per inch of length, according to the size or particular use for which they are intended. This gives a longitudinal relief to the drill, which is very essential in accurate drilling.

Body Clearance.

Neither are drills exactly round, as their diameter is eased away from a short distance behind the cutting edge back to the flute, as in Fig. 1. The part between A and B is of full diameter and round, while that from B to C is eccentric, or, more strictly speaking, is a surface whose cross section is a spiral with its centre in the centre of the drill. This is called body clearance.

Fig. 2



The object of this is to give radial clearance to the drill, and thereby reduce the friction between the drill and the walls of the hole. Without this body clearance more power would be required to turn it, and in some cases enough heat would be generated to draw the temper of the drill to a degree which would unfit it for further use.

Web Increase.

To give the drills as much strength as possible the flutes decrease in depth towards the shank, that is the "web" between them gradually increases in thickness towards the shank; this is accomplished by gradually withdrawing the milling cutters as they approach the shank, and is called web increase.

This operation alone would seriously impair the chip room in the tool, and to avoid this defect the spiral is increased in pitch, thus widening the flute by an amount that, combined with the web increase, will preserve the correct and equal cross sectional area of the flute from point to shank.

This is made plain by reference to Fig. 2, in which the cutter C is in position at the point of the drill with its path on line A-B. As the blank is fed uniformly forward it revolves at a rate which is constantly diminishing, and as the axis of the cutter remains in a fixed angular relation to the axis of the drill it is obvious that the flute will be wider at the shank end than at the point, and at the completion of the groove the cutter will be in position shown by dotted lines; but as the cutter is gradually withdrawn in depth the combination of these two movements retains the proper volume of the flute for free egress of chips.

Feed Pressure and Torsional Stress.

The general contours of the feed pressure curves for tool steel are very much alike, showing a steady rise until the lips are cutting nearly full size, then dropping slightly, due to the spiral helping to pull the drill in; then rising again steadily to a point about a third through

the billet, due no doubt to the billet not being annealed uniformly clear through.

The feed pressure diagrams fall off very rapidly as the point begins to come through, while the torsion diagrams for steel rise very abruptly; and the tool

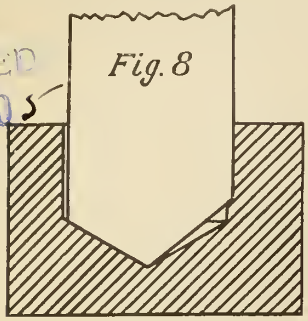


Fig. 8

steel one (the piece not being clamped down) shows plainly where the lips caught and raised the piece, giving several very quick jerks, a result which is experienced very often when holding a piece by hand to drill it.

These jerks indicate where drills are generally broken, especially when lever feeds are used, or the spring between the parts of the drilling machine taking thrust is considerable. This feature is very common in the drilling of the rivet holes in cylindrical shells, where the inside curvature greatly augments the tendency of the drill to "hog in."

The feed in this test was purposely kept down to what may be termed fair practice in order to have the same grinding answer for all three holes. The difference between the curved lines pointing toward the centre represents a distance of .05 inch in depth drilled, on both charts. To find the actual feed pressure in pounds multiply the indicated pressure on chart by 20. To find the

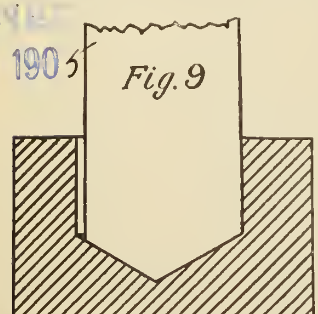


Fig. 9

torsional stress in pounds at the periphery of the drill, multiply the indicated pressure on the chart by 20 and divide by the diameter of the drill.

Power Consumed in Drilling a Hole.

In tests the Cleveland Twist Drill Co. found the shape of groove, the angle of point, the angle of spiral, and the manner of grinding all affected the power needed to drill a given hole. The thickness of web also affected the result, but this is probably the most uniform feature on the different makes of drills, and varies but slightly.

Form of Chip an Index.

The form of the chip is very similar to an open spring wound with ribbon steel, and somewhat resembles a cylinder in appearance, see Fig. 6. Fig. 5 represents a form of point very desirable for several reasons, and is the shape which we have adopted. It does not require any more power (in fact slightly less) than the point like Fig. 4, and rolls a beautiful chip (see Fig. 7), the turns of which are conical in shape and slightly less in diameter than those of Fig. 6, but lying one within another so that the length of chip in drilling a hole one inch deep is not a quarter as long as that made by a point like Fig. 4 drilling the same depth.

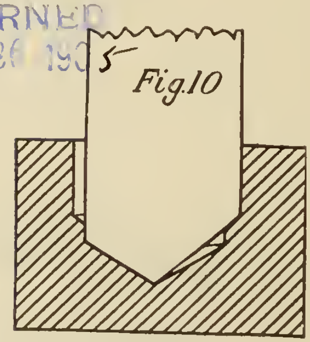


Fig. 10

Angle of Point Affects Feed Pressure.

Our tests with different angles of points showed that the feed pressure varied almost directly with the number of degrees in the included angle of the point between 110 and 130 degrees. Different materials gave somewhat different results, the variation being not so great in the harder metals.

Point Grinding.

Next to a drill being properly made and tempered, it is of the utmost importance that its cutting edges be properly ground to get the maximum results in drilling. This means that both cutting edges must have the same inclination to the axis of the drill, and be of exactly the same length; this will of course bring the centre of the cutting edges or point in the true centre of the drill, and will produce a round and smooth hole. To get maximum results both these requirements must be carefully observed. It is not sufficient to have one condition correct, but both of them. If the point be central but the angle of the cutting edges different, the drill will bind on the side of the hole opposite to that side of the point which is cutting, will drill too large a hole, and all the work will fall on the one

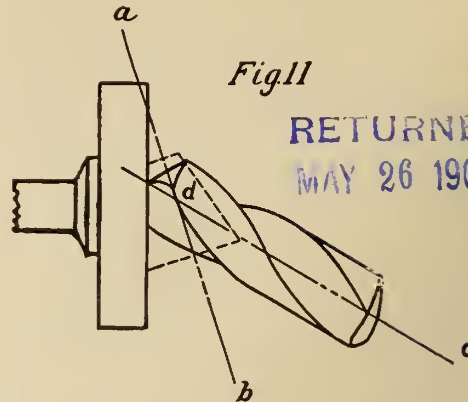


Fig. 11

cutting edge. Fig. 8 illustrates this, while Fig. 9 shows a point ground with equal angles, but with the cutting edges of different lengths, which will result in the hole being too large.

When both angle and length of cutting edges are wrong the drill will be laboring under the severe conditions shown in Fig. 10, and the support spoken of in paragraph on "diametrical support" entirely lost.

Twist Drill Grinding Machines.

The machines which grind on the last-named system nearly all come under the head of form or cam machines, that is the shape is produced by copying a template or the motion of a cam.

In Fig. 11 the dotted lines show the complete frustum of the cone in about the right position for the best all-round results. In Fig. 12 the axis of the

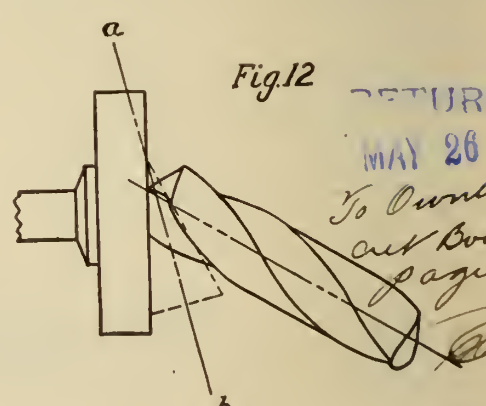


Fig. 12

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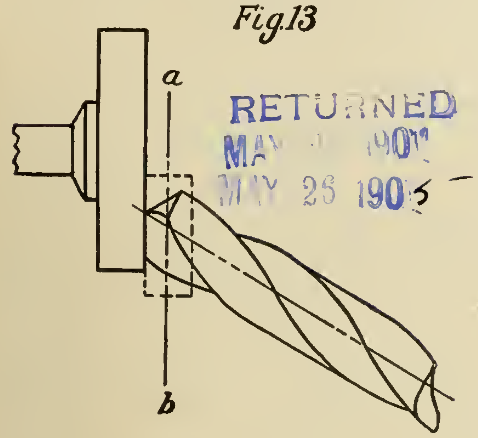
cone intersects the axis of the drill too near the drill point.

Lip Clearance.

Another very important feature of grinding a drill point is the lip clearance or proper backing off of the cutting

edge. To do this correctly, even on a machine, is a difficult problem. Our idea of the correct form to which the lip of a drill should be ground is that of a segment of a cone whose axis is on line a-b Fig. 11 and at an angle b-d-c

Fig.13

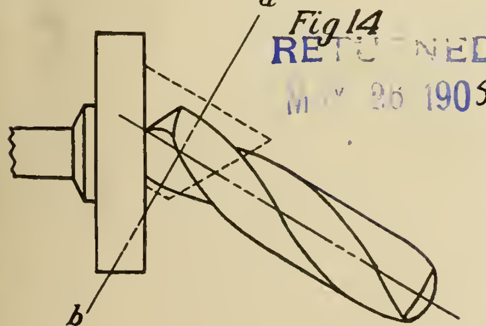


to the axis of the drill. There is, however, a difference of opinion among engineers as to just what shape this end of the drill should be, some favoring that shape which corresponds to a segment of a cylinder, some an inverted cone, and still others a cone of irregular contour.

Fig. 13 illustrates the point whose surface is a segment of a cylinder, and Fig. 14 represents the inverted cone with axis on line a-b, dotted lines show the frustum complete. In both these forms of point (Figs. 13 and 14) the radius of curvature is too small at the outside or periphery compared with that at the inside or centre (when the clearance angles at the centre are correct).

Another important thing to be considered in grinding drill points is the angle of lip clearance. The angle of lip clearance must not be confused with the shape of the point just dealt with.

Fig.14



Our experience shows that 12 degrees is the best angle at the periphery, and this should be gradually increased as the centre of the drill is approached until the line across the centre of the web stands at an angle with the cutting edges approximately as shown in Fig. 15. For heavier feeds in soft material the angle of lip clearance may safely be increased to 15 degrees.

Angle of Spiral.

There are various shapes of flute and angles of spiral on the drills made by different manufacturers, the shape of flute varying by only a small amount, while the angle of spiral ranges from 18 degrees to 35 degrees.

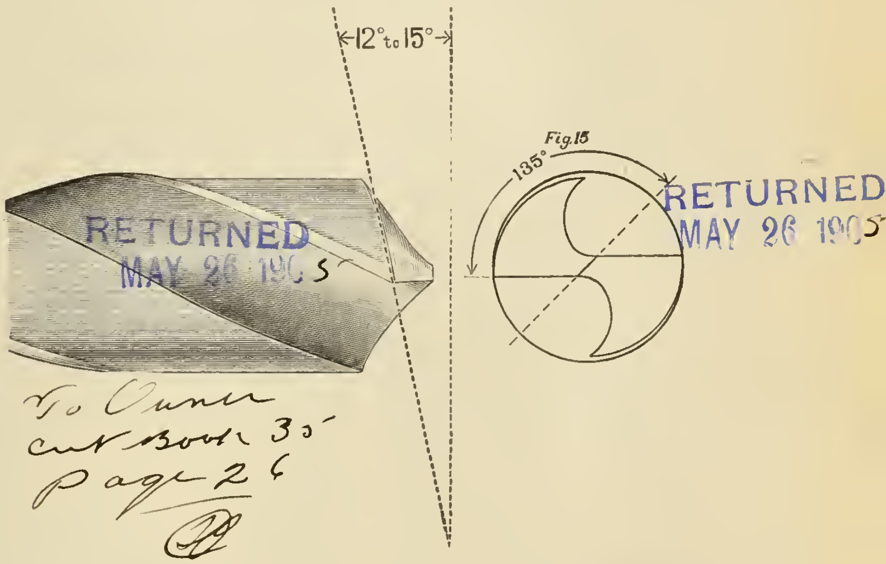
Theoretically the finer the pitch of the spiral grooves or the greater the angle of spiral to the axis, the easier it should sever and bend or curl the chip; but practical considerations arise which counteract the advantage of mere ease in severing chips, and it becomes advisable to make this angle somewhat more acute than would otherwise be the case. Among the practical objections to a very fine pitch of spiral may be mentioned the weakness of the cutting edge and its inability to carry off the heat generated. Such a groove also packs up with chips more readily.

Pitch of Spiral.

From a large number of tests made we have found that the practical range of this angle of spiral for the regular commercial article is between 30 degrees and 25 degrees, assuming that the average drill is to make a hole from one to three diameters deep. For deeper holes than this a smaller angle might be advisable, and for shorter holes a greater one. The difference in torsional stress on the drill does not vary by any considerable amount when the angle of spiral ranges between 30 degrees and 25 degrees with the axis. We therefore use an angle of 27 1-2 degrees for reasons which facilitate the operation of milling the grooves and to simplify the curves on the cutter, to produce a straight lip of the form shown in Fig. 5. This angle of 27 1-2 degrees with the axis makes the spiral groove of all drills start at the point with a pitch equal to six diameters of the drill blank, the increase in twist being a constant function of the angular movement of rotation of the drill blank, This with a uniform web increase retains a strict uniformity in the pitch of grooves, and curves of cutters for the entire system of regular drills, and gives the form which our experience has shown to be the most effective for the average work a drill is called upon to do.

Speeds of Twist Drills.

The subject of the speed at which a drill should run and the feed per revolution is one on which engineers differ very radically, and the extremes of



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heavy feed with slow speed and light feed with fast speed are both supported by indisputable data. No rule can be given to cover all cases, and the ordinary tables published should be considered as guides only; the correct speeds should be determined by good, sound judgment for each particular case. One thing is certain, if the drill chips out at the edge there is either too much lip clearance or too much feed.

(To be continued.)

The Globe Refining Co., who are developing the graphite properties near Perth, has disposed of its first year's output in Germany for $150 per ton. The product is used in the manufacture of crucibles. A factory to make crucibles in Ontario is under consideration.

ENGINEERING NEWS

AND BUSINESS MEETINGS

Engineering Society, S.P.S.

OFFICERS of the Engineering Society of the School of Practical Science for ensuing year are: President, E. A. James; vice-president, Wm. Treadgold; recording secretary, G. W. Graham; treasurer, A. R. Munro; corresponding secretary, F. R. Ceasar.

Canadian Mining Institute.

Officers for 1905: President, George R. Smith, M.L.A., Bell Asbestos Co., Thetford Mines, Quebec; vice-president, Thomas Cantley Nova Scotia Steel and Coal Co., New Glasgow, N.S.; Dr. W. L. Goodwin, director School of Mining, Kingston, Ont.; Dr. Frank D. Adams, McGill University, Montreal, Quebec; secretary, H. Mortimer Lamb, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Marine Engineers.

The officers are: E. S. Henning, Toronto, grand president; Neil J. Morrison, St. John, N.B., grand secretary (re-elected); Charles Robertson, Owen Sound, conductor; Therian, Levis, doorkeeper; Gillies, Kingston, and Cronk, Windsor, auditors.

Engineers' Club of Toronto.

The officers of the Engineers' Club of Toronto for the year of 1905 are: President, R. F. Tate; first vice-president, F. L. Somerville; second vice-president, T. B. Smith; directors, A. B. Barry, G. R. Mickle, W. H. Patton; auditors, T. B. Speight, J. S. Fielding; treasurer, W. J. Bowers; secretary, Willis Chipman.

Canadian Society of Civil Engineers.

The officers for this year are: President, Earnest Marceau, Montreal; vice-presidents, C. H. Keefer, Ottawa; D. Macpherson, Montreal, and G. A. Mountain, Ottawa; councillors, John Kennedy, W. F. Tye, G. A. Keefer, C. H. Rust, A. E. Doucet, Phelps Johnson, R. W. Leonard, P. W. St. Geo[illegible] [illegible]. B. Mackenzie, Prof. R. B. Owens, M. J. Butler, Prof. R. J. Durley, G. J. Desbarats, Dr. J. B. Porter, and H. C. Burchell; nominating committee, for Ontario, G. A. Mountain, C. H. Rust and Prof. J. Galbraith; for Quebec, F. Shearwood and W. McLea Walbank; for Northwest Territories, G. H. Webster; for Maritime Provinces, F. W. W. Doane; outside of Canada and Newfoundland, H. Irwin.

Canadian Electrical Association.

Officers: President, K. B. Thornton, Montreal, Que.; 1st vice-president, A. A. Wright, Renfrew; 2nd vice-president, R. G. Black, Toronto; secretary-treasurer, C. H. Mortimer, Toronto; executive committee, F. Thompson, Montreal; A. B. Smith, Toronto; John Murphy, Ottawa; A. A. Dion, Ottawa; Gordon Henderson, Hamilton; B. F. Reeson, Lindsay; A. E. Evans, Quebec; C. B. Hunt, London; J. A. Kammerer, Hamilton; J. J. Wright, Toronto.

Toronto Branch A.I.E.E.

Executive committee, J. A. Kammerer, R. G. Black, K. L. Aitken; chairman, T. R. Rosebrough; vice-chairman, H. A. Moore; secretary, R. T. Mackeen.

* * *

Engineers' Club Meetings.

The April meetings of the Engineers' Club of Toronto, have been arranged as follows: Thursday, April 6th, paper on "Car Wheel Manufacture," by S. Dillon-Mills; Thursday, April 13th, paper, "A Smokeless City," by A. N. Wickens; Thursday, April 20th, paper on "Bridge Shop Practice," by A. R. Leicester; Thursday, April 27th, paper, "Water Purification," by J. G. Russel Duncan. The weekly Wednesday luncheons of the club will be discontinued after April 27th.

Toronto Automobile Club Banquet.

About 75 motor enthusiasts attended the second annual banquet of the Automobile Club, at the National Club, on Monday, April 10th. The key-note of the speeches was in the direction of good roads, better horses, better laws, and the observance of the golden rule of the road. Dr. P. E. Doolittle presided, with M. C. Ellis in the vice-chair.

Mr. A. W. Campbell, Deputy Commissioner of Public Works, responded on behalf of "Our Highways." He outlined what had been done to improve the highways, and suggested continuous highways of permanent character between the Province of Quebec and the Detroit River. He hoped to see the roadways put in such a condition that a rural mail system would be adopted.

Electrical Engineers Dine.

The Toronto branch of the American Institute of Electrical Engineers had a dinner at the King Edward Hotel on Friday, April 14, after which a meeting was held in the Engineers' Club rooms, King street west. A paper was read by Mr. F. O. Blackwell of New York, on the subject of Niagara power development.

Goldie & McCulloch Concert.

The 22nd annual concert of the Goldie-McCulloch Co.'s employes was held on the 31st of March, in the Opera House, Galt. There was a lengthy and varied bill, which was carried out much to the satisfaction of the onlookers, judging from the encores that were given the different numbers.

Prize for Original Paper.

The Engineering News Publishing Co. is offering $350 in two prizes, to be given for the best paper on the "Manufacture of Concrete Blocks and Their Use in Building Construction," with the view to stimulating the production of literature on the subject of concrete block manufacture and construction. The author whose paper is judged to be best will receive a prize of $250, and the one second in rank a prize of $100. The merit of the papers will be judged chiefly from the standpoint of their usefulness to an engineer who proposes to establish a local business in the manufacture of concrete blocks.

An International Congress.

An international congress of technical education is to be held at Milan, Italy, in 1906. It has not yet been decided what dates the meetings will be held, but as it is also proposed to hold an international congress of commerce and industry at the same place it is altogether likely that it will be arranged to hold the two about the same time.

Paper on High Tension.

At a meeting of the Engineers' Club, Toronto, held recently, Mr. K. L. Aitken, consulting engineer, presented a paper entitled, "Relation between high tension lines and other lines." A large number of members were present, and the paper was followed by an interesting discussion.

Frazil Ice Formation.

Dr. Howard T. Barnes, professor in physics of McGill University, who is the acknowledged authority on ice formation, read a paper on the formation of frazil and anchor ice in the St. Lawrence River, at the American Society of Mechanical Engineers in New York.

Certificated Stationary Engineers.

A deputation of stationary engineers, among whom were Thomas Walsh, D. G. Bly, G. D. Wright, J. Blain and Thos Fox, waited on Premier Whitney and Hon. Nelson Monteith recently. They asked that an act be passed by the Local Legislature compelling all stationary engineers to hold a certificate endorsed by a committee appointed under the provision of the act. They pointed out the efficacy of the Dominion Marine Boiler Inspection Act and the stringent precautions regarding qualifications of stationary engineers in British Columbia and Quebec. The Premier promised to give the matter due attention.

CANADIAN

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WOOD-WORKING MACHINERY IN DEMAND.

EVERYTHING points to a year of unusual activity in machinery circles in Canada. More new industries are about to be established this year than ever before. The industrial forward movement gives evidence of this, and its influence is extended to all branches of the machinery trades. In spite of the fact that the general demand is greater, wood-working machinery takes the lead, as far as numbers of orders and volume of business is concerned. This is particularly true in the northern districts of Ontario and Quebec, where much new country has been opened up within the past few years, and in these, wood-working machinery is required long before metal-working industries gain a footing.

AN IMPORTANT DECISION.

A CASE of unusual importance to mechanics and trade unions generally was decided recently at St. Catharines, when the different labor unions were fined $1,500 for boycotting the goods manufactured by the Gurney Foundry Co. An open shop was run by the company, who refused to hire union men exclusively, whereupon the shop was declared "unfair," and circulars issued by the unions to that effect. Figures were given showing that the Gurney business in Hamilton had fallen off from over $4,000 in 1901, to $800 in 1904 as a result of circulars sent out to different firms warning them against handling the Gurney goods. After three days' proceedings, in which the judge charged strongly against the union boycotters, the jury brought in a verdict against the representatives of the union. This is one of the most important decisions that has been given in connection with labor troubles for some time and if, as is intimated, the trade unions repeal the decision, the result will be watched with interest, not only by mechanics and workmen, but by all manufacturers and employers of labor.

STEAM ENGINE vs. GAS.

THE recent adoption of steam turbines in steamships has aroused discussions as to the desirability of their general use and the question of a steam turbine ultimately replacing the reciprocating engine has come to be a more prominent issue. There is little prospect that the steam turbine will replace the engine in common use to-day, not only on account of the fact that the latter is so well established, but also for the reason that there is another factor to be considered in the question. This is, the gas engine of a marine type burning producer gas which can be run at much greater economy both in fuel and steamship space than either the modern steam turbine or the most improved type of steam engine.

A British authority describes the ideal marine engine of the future and one whose advent is well within the bounds of possibility. It will be able to burn kerosene, alcohol, gasoline, or any hydrocarbon which happens to be available. Electric ignition will be eliminated and the charge exploded automatically. The compression will be high and, instead of a carburetter or vaporizer which chokes, leaks or backfires, the cylinders will be filled with cold air and the fuel introduced afterwards—the whole being something on the order of the Diesel engine. The mechanical part of the ideal engine will be lighter than at present and the lubrication will be entirely automatic. It will start at once, not 99 times in 100, but every time, and it will not require an expert to start it. Finally, it will be proof against sea water, damp, wind, oil and grease, and will have to be placed on the market and sold from stock in sizes up to 500 or 1,000 horse-power.

A steam engine with its necessary boilers, fuel and water weighs six times as much as the explosion engine with its fuel for the same power, speed and range of action. The latter also requires less attention and no boiler attendance. If it becomes possible to combine the turbine principle with the explosion engine principle an ideal condition will have been reached as far as knowledge at present goes along these lines. This, however, has not yet been accomplished, although numerous experiments have been conducted along that line. The steam engine has held full sway for several generations and is yet bound to play an important part as a power producer, but more and more, as time passes, the merits of the gas engine are being recognized and this prime mover raised to a status that demands attention from all interested in power production.

WIRELESS TELEGRAPHY OUTLOOK

SINCE his arrival in the country Signor Marconi has been vigorously prosecuting his schemes in connection with wireless telegraphy. He has recently invented some radical improvements on which tests have not yet been made, and is confident that when a new plant is in operation at Glace Bay messages may be sent at a speed of over one hundred words a minute.

Over $200,000 have already been expended on their station in connection with which eight spars, each 180 feet high, have been placed in position, to be supplemented by 16 more at an early

date. Several other stations on the coast will also be placed in operation, and with successful culmination of this project steps will be taken to communicate with Gibraltar and the Mediterranean. It is gratifying to note the interest the Dominion Government has taken in this question. The projected stations at Halifax and Sable Islands will be installed this Summer, and it is expected that before the year is out overland communications will be made to Winnipeg and Vancouver.

NINETY THOUSAND MEN WANTED.

Manitoba is calling for 90,000 men, and the request is urgent. This is the intimation given by the Government Immigration Agent of the province, who is in the closest touch with existing circumstances. Here are chances and possibilities and prospects for men crowded in the uncongenial environment of the cities to secure work that is conducive to mental and bodily vigor. There is little excuse for idleness with such a call at hand, and it is hoped that it may reach the ears of those ready to listen, and that it may be answered by those whose condition will be bettered, and who will have cause to be thankful for the change.

"THE KNOWING HOW."

ATTENTION is called to an article on this subject in the current issue by Mr. W. H. Wiggs, of the Mechanics' Supply Co., Quebec, in which the writer lays emphasis on the question of increasing our knowledge, in a manner calculated to stimulate the thinking and the observant. Apropos of this, an exchange gives a list of those not likely to succeed in life, which includes the idler, the leaner, the coward, the wobbler, the ignorant, the weakling, the smatterer, the indifferent, the unprepared, the educated fool, the impracticable theorist, those who watch the clock, the slipshod and the careless, the young man who lacks backbone, the person who is afraid of obstacles, the man who has no iron in his blood, the person who tries to save on foundations, the man who is always running to catch up with his business, the man who can do a little of everything and not much of anything, the man who wants to succeed but who is not willing to pay the price, the one who tries to pick only the flowers out of his occupation, avoiding the thorns.

REINFORCED CONCRETE BUILDINGS.

THE experimental stage has been passed in the construction of steel reinforced concrete buildings, and their strength and durability is now an established fact. While those of modern construction have not yet had time to prove their endurance, sufficient evidence of the lasting quality of cement is to hand to demonstrate beyond cavil its importance. As a building material it has for centuries established its place in the architectural world. We have but to turn to the examples of concrete construction left us by the Greeks and Romans to be convinced of its ability to resist the ravages of time and its imperviousness to changing climatic conditions and the effects of exposure to the elements. Accurate scientific tests have as satisfactorily demonsrated that it is equal to any other known material in sustaining weight, and hence the increasing tendency to employ the steel reinforced concrete as the frame work of structures. Whatever prejudice architects may have entertained towards the use of concrete as the chief component feature of buildings, has been dissolved, and we find eminent architects everywhere designing plans which contemplate the use of this material. Its susceptibility to ornate treatment, its adaptability to all degrees of temperature, and its absolute resistance to the effects of fire are important factors favoring its use.

NEW USE FOR MERCURY ARC RECTIFIER.

AN interesting field has lately been presented for the use of the mercury arc rectifier. This is its adoption for rectifying the current, to charge batteries of electric launches. At the Motor-Boat and Sportsman's Show, Madison street Garden, New York, the General Electric Co. exhibited one of their mercury arc rectifiers in full operation for this purpose. The alternating current used was 220 volts at 60 cycles, being commutated to direct current at 110 volts, 30 amperes being the amount of flow. This use should also be made of the mercury arc rectifier for automobiles and should prove a boon to the manufacture of electric cars for touring, as it does away with the need of rotary converters. Small charging stations should be established at hotels catering to automobile traffic at a low expense, and with the adoption of these, tourists will be enabled to move about throughout the country that is, in general, impracticable at present.

HARDENING COPPER.

DISCOVERERS of the art of hardening copper have been as numerous in the past as perpetual-motion experts, and little seems to have been accomplished in either direction. The latest announcements along this line come from Halifax, where two gentlemen claim to have made knife blades of copper, keen and of permanent duration. Admitting this to be true, what is the advantage gained by such a discovery, and to what use could the method be applied that is not already covered by other metals? If the discoverers commenced figuring on making tools or implements of copper it will take but a moment to demonstrate the fact that its relative cost in comparison with steel will prevent its being utilized for such purposes.

This raises the question, was copper ever tempered? No tools of tempered copper such as would cut rock, for instance, have ever been found, and in the most ancient rock mines of the world, in Spain, Cornwall, Hungary and Asia Minor, the ancient marks are all those of steel tools. The credit of possessing the knowledge of tempering copper has been given to the Phoenicians, the Egyptians and the Chinese, but amongst none of their relics are hard copper tools found. In none of the museums, where implements of the past are collected, are there any of this kind, and, although such is only negative evidence, it is enough to admit of questioning the well-established belief that the ancients were possessed of secrets whereby copper was tempered by them

THE ELECTRIC RAILWAY ERA.

WHILE Canada has not advanced as far as many of the States to the south in the matter of electric railways, much progress has been made, and from all sections come reports of proposed development. The next five years will certainly see marvellous progress made, and the country districts adjacent to the large cities will be covered with a net work of electric lines.

Another phase of this question is the increasing use of electric power on steam railways. The C.P.R. has handed over its branch line from Vancouver to Steveston, and in future it will be operated with electric power by the B. C. Electric Railway. And the New York Central has adopted an electric locomotive for use on its suburban lines, it being the pioneer in this respect in the United States.

Within two years the New York Central will not have a steam locomotive in commission in a radius of forty miles from New York. Changes are now in progress involving an expenditure of fifty million dollars in preparation for the installation of electricity as the motive power to the extreme limit of the suburban zone of the road. When these are completed, the suburban service will have a two-minute headway over four tracks, and the through traffic will all be taken into New York City by immense electric locomotives of three thousand horse-power. This constitutes a revolution in railway methods, for it is but one step from the electrifying of the suburban service to the complete substitution of electricity for the whole system.

The locomotive which the New York Central has adopted has many advantages over steam. They have been driven at the rate of 75 miles an hour, and are capable of developing 90 miles an hour. They weigh only 85 tons against 150 tons for the Atlantic type of steam locomotives. They can be started, attain full speed, and come to a standstill well within a distance of four miles, or while one of the heavier steam locomotives gets really under way. Then the driver is directly in front, and can see the track straight ahead of him, minimizing the danger of collisions. Traveling is rendered more comfortable by the absence of smoke and cinders. All these advantages, with the certainty of lower rates and better service, open up the prospect of a new era in railroading.

Concurrently with the installation of electricity, the New York Central is taking up the question of abolishing grade crossings, and will carry out a broad policy at very great expense. Thirty-five million dollars will be expended in depressing tracks, increasing trackage, abolishing grade crossings, and making changes in terminals and stations. These are all necessary to give the two-minute service and handle with safety and expedition the 500 to 700 trains that enter New York over the company's track every 24 hours. It is the most important movement in the history of railroading, for it marks the beginning of the end of the steam locomotive.

TELEPHONE QUESTION DORMANT.

THE proposal of Sir William Mulock to conduct a telephone system under post office auspices, if carried to a successful issue, would be as great an accomplishment and as much to his credit as the two-cent postage introduced through his efforts. He would have telephone stations all over the country when required by the inhabitants, just as post offices are located now. There is no reason why this should not be accomplished, and, under Government control, telephones would be introduced and extended in the manner and at a rate altogether impossible or at least hopeless under existing private corporations. A Parliamentary committee has been appointed at Ottawa to report on the nationalization of telephone systems, and as soon as it has completed its labors, definite steps will in all probability be taken, but until such time the question is being held over. The following has been proposed by the legislative committee and endorsed by the Toronto City Council: "That the Dominion Government and Parliament be petitioned to take into careful consideration the question of establishing, maintaining and operating a telephone service under direct Government management, similar to that under which the postal service is at present carried on." Another proposal was that of Government ownership for long-distance lines and municipal ownership and operation of local lines.

AN EPOCH IN OCEAN TRAVEL.

WITH the arrival of the new Allan Line steamer "Victoria" at Halifax harbor on the morning of April 1, a new era in trans-Atlantic transportation was inaugurated. That the first trip was eminently successful is already well known and the owners of the ship are open to congratulation on the event. This trip of the "Victorian" has been looked to with interest throughout the world, as she is the first of her kind to be built and equipped with steam turbines for commercial service. The lack of vibration was greatly appreciated by the passengers, and this will no doubt be a material factor in the consideration of adopting steam turbines in ocean-going boats where the comfort of passengers is an all-important consideration.

There are other points as well in favor of the steam turbine, the most notable of which is economy of space. Data on relative fuel consumption compared with that of reciprocating engine is not yet available, so that comparisons cannot be made regarding saving in fuel.

MANY COMPANIES INCORPORATED.

ONE of the most direct evidences of the forward movement in Canada is the incorporation of a large number of new companies every week. Since the first of the year they have been unusually numerous, representing a capital stock aggregating over thirty million dollars. Most of the companies are either erecting new plants or enlarging those already established, ensuring an increasing demand for all classes of machinery and supplies.

Practical Questions and Answers

Ques.—Whether is copper or iron more easily fused and what their relation to other metals regarding point of fusion?

Ans.—The fusing point of copper is lower than that of iron. Regarding the other metals, commencing with the most easily fused, they are: tin, lead, zinc, aluminum, silver, gold, copper, iron and platinum. It might also be interesting to note their relative position as to tenacity, ductility and malleability. Regarding tenacity, commencing with the least tenacious, they are: lead, tin, gold, zinc, silver, platinum, aluminum, copper and iron. As far as ductility goes, the most ductile is platinum, followed by silver, iron, copper, gold, aluminum, zinc, tin and lead. Concerning malleability, as is fairly well known, gold occupies first position in this list, then silver, aluminum, copper, tin, lead, zinc, platinum, iron.

Mr. Edward Julien, St. Remi, P.Q., writes: "Could you tell me the price of a shaving and a sawdust-gathering machine for a saw cutting 2,000 ft. of lumber?"

Ans.—These are manufactured by the B. F. Sturtevant Co., Hyde Park, Mass., and Sheldon & Sheldon, Galt, Ont., who will, no doubt, be pleased to supply full information.

Ques.—(1) What are the ingredients and proportions used in casting statuary bronze figures? (2) Is this work done in Canada? (3) Can the raw material be purchased all ready for casting? (4) What is the cost approximately per 100 lbs.? (5) What is the shrinkage?

Ans.—(1) The modern bronzes are made in the proportion of 91 per cent. copper, 2 per cent. tin, 6 per cent. zinc, and 1 per cent lead. This is the proportion adopted by the French who make the best bronzes known. In making these the metals are melted separately and the other metals added to the copper and stirred until the mixture is homogeneous. It is then turned into the mould as quickly as possible and when the exterior is sufficiently solidified the casting is uncovered in order, by hastening the setting of the interior, to prevent as much as possible formation of strata of unequal composition, which is liable to occur from the great difference in the fusibility of the different metals, that of copper being above 2,200 degrees Farenheit, while tin melts at 420 degrees and lead considerably lower. (2) None of this work is done in Canada at present and very little in the United States. The bulk of the bronzes imported to this country in the way of statuary comes from Germany and France, those of the latter country being more preferred, since they are of a finer finish and more artistic. (3) Yes, from the different metal dealers throughout the country. (4) For 100 lbs. of a mixture at the present market prices of metal, copper 16¼c., tin 33c., zinc 5½c., and lead 3½c., the cost per 100 lbs. would be approximately $16 before melting. (5) The shrinkage of bronze is somewhat greater than that of iron and an allowance of 3-16 of an inch per foot should be made.

Ques.—What are the different expressions used in regard to finding the circumference, diameter, radius, and so forth, of a circle, that is, the numerical factors used? Also other areas used in mensuration?

Ans.—To find circumference—
Multiply diameter by 3.1416.
Or divide diameter by 0.3183.

To find diameter—
Multiply circumference by 0.3183.
Or divide circumference by 3.1416.

To find radius—
Multiply circumference by 0.15915.
Or divide circumference by 6.28318.

To find side of an inscribed square—
Multiply diameter by 0.7071.
Or multiply circumference by 0.2251.
Or divide circumference by 4.4428.

To find side of an equal square—
Multiply diameter by 0.8862.
Or divide diameter by 1.1284.
Or multiply circumference by 0.2821.
Or divide circumference by 3.545.

Square—
A side multiplied by 1.4142 equals diameter of its circumscribing circle.
A side multiplied by 4.443 equals circumference of its circumscribing circle.
A side multiplied by 1.128 equals diameter of an equal circle.
A side multiplied by 3.545 equals circumference of an equal circle.
Square in. multiplied by 1.273 equals circle inches of an equal circle.

To find the area of a circle—
Multiply circumference by one-quarter of the diameter.
Or multiply the square of diameter by 0.7854.
Or multiply the square of circumference by 0.07958.
Or multiply the square of one-half diameter by 3.1416.

To find the area of an ellipse—
Multiply the product of its axes by .785398.
Or multiply the product of its semi-axes by 3.14159.

Contents of cylinder = area of end × length.

Contents of wedge = area of base × one-half altitude.

Surface of cylinder = length × circumference + area of both ends.

Surface of sphere = diameter squared × 3.1416, or = diameter × circumference.

Contents of sphere = diameter cubed × 0.5236.

In last issue of Canadian Machinery the question was asked, How do you find the horse-power transmitted by a belt of a certain width, running at a given speed? Does the rule given apply to all conditions, and what is the safe driving power for different widths?

Ans.—A simple rule to find the driving power of belts is to divide the speed in feet per minute by 1,100. The quotient will be the horse-power per inch of the belt's width that is allowed in good practice to be transmitted by single-thickness leather belting having laced joints. Although this is the best practice, the amount is often exceeded by as much as 25 per cent. with satisfactory results, though the life of the belt is shortened.

Double-thickness belts will transmit twice and triple-thickness belts three times as much power as single-thickness belts.

Spliced belts will transmit a third more power than those that are laced.

The adhesion of belts to pulleys, and the consequent driving power, vary so much under different conditions of use that some intelligent deviation is occasionally necessary from any simple rule. From the horse-power given by the above rule, therefore, some deduction should be made when the belt is vertical or inclined instead of horizontal; when the arc of contact on the pulley is much less than 180 degrees or a "half wrap"; when the speed of the belt is less than 900 feet per minute, and also when one or both of the pulleys are small in diameter.

Five per cent. should be deducted for every ten degrees less than a "half wrap."

Twenty-five per cent. should be deducted for vertical belts when used without a tightening pulley.

In the case of small pulleys deduct from 0 to 60 per cent. for single belts on pulleys from 12 in. to 2 in. diameter, double belts on pulleys from 24 in. to 6 in. diameter, and triple belts on pulleys from 36 in. to 15 in. diameter.

When circumstances permit, the best speed for belts is about 5,000 feet per minute. The adhesion is then so good as to require less stretching of the belt with less consequent loss of power by friction.

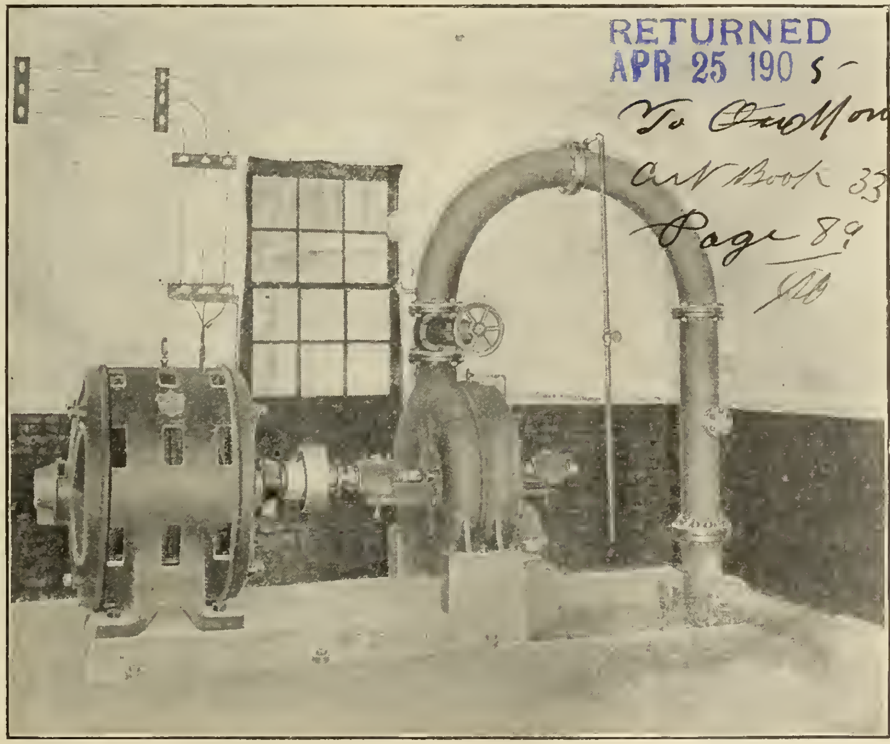
The smoother the surface of the pulleys and of the belt surface in contact with them, the better is the adhesion and the greater driving power. It is, therefore, sometimes found of benefit in the case of low-belt speeds or of pulleys of small diameter to cover the pulleys with leather or to make them of wood, polished, and to run the hair side of the belts in contact with the pulley faces.

Power and Transmission

Steam *Gas* *Electricity* *Compressed Air* *Water*

MOTOR-DRIVEN PUMP.

THE electric motor enters a wide field of usefulness in driving pumps. The simplicity and durability of the sets, especially when induction motors are used, render them particularly desirable where little skilled labor is available. The problem of unwatering the great Comstock Lode in Nevada, which defied engineering effort for 26 years, has now been solved by the installation of pumps driven by 800 h.p. slow-speed induction motors. These motors are also coming into general use for municipal and private pumping stations, both for domestic and fire purposes. There is illustrated herewith a 200 h.p. induction motor, built by Allis - Chalmers - Bullock, Limited, Montreal, directly connected to a turbine pump for fire protection at the Canada Sugar Refinery, Montreal.



Motor-Driven Pump, Canada Sugar Refinery, Montreal.

SPLICING WIRE ROPE.

Wire rope is susceptible of the most perfect splice. A better splice can be put in a wire rope than in any other kind of rope, for the simple reason that it is made with a view to this purpose. It has just the desired number of strands, namely, six, and a hemp core, which provides a place for fastening the ends. It is a plain, simple process, and but the work of an hour for any one to learn.

The Necessary Tools.

A hammer and sharp cold chisel for cutting off ends of strands; a steel spike for opening strands; two pieces of heavy tarred marline or thin rope with sticks; a pocket knife for cutting the hemp core; a wooden mallet and block. (See Fig. 5 for untwisting rope.)

First—Put the rope around the sheaves and heave it taut with good block and fall. The blocks should be hitched far enough apart so as to give room between to make a twenty-foot splice. A small clamp may be used to prevent the lashing from slipping on the ropes where the blocks are hitched. Next, see that the ropes overlap about twenty feet—about ten feet each way from the centre—as shown by the dotted lines in Fig. 1. Mark the centre of both ropes with a piece of chalk, or by tying on a small string. Now proceed to put in the splice, with the blocks remaining taut when it is necessary, but the better way is to remove the blocks, throw off the rope from the sheaves, let it hang loose on the shafts, and proceed with the splice on the ground, floor or scaffold, as the case may be.

Second—Unlay the strands of both ends of the rope for a distance of ten feet each, or to the centre mark as shown in Fig. 2; next cut off the hemp cores close up, as shown in Fig. 2, and bring the bunches of strands together so that the opposite strands will interlock regularly with each other. See Fig. 3.

Third—Unlay the strand A, and follow up with one strand of the other end, laying it tightly in open groove made by unwinding A; make twist of the strand agree exactly with the twist of the open groove. Proceed with this until all but six inches of 1 are laid in, or till A has become ten feet long. Next cut off A, leaving an end about six inches long.

Fourth—Unlay strand 4, of the opposite end, and follow with strand D, laying it into open groove as before, and treating this precisely as in the first case. See Fig. 2. Next, pursue the same course with B and 2, stopping four feet short of the first set. Next, with 5 and E, stopping as before; then, with C and 3; and lastly with 6 and F. The strands are now all laid in, with ends four feet apart, as shown in Fig. 4.

Fifth — The ends must now be secured without enlarging the diameter of the rope. Take two rope clamps (see Fig. 5) and fasten them to the rope, as shown in Fig. 6. Twist them in opposite directions, thus opening the lay of rope. (See Fig. 6.) Next, with a knife cut out the hemp core about six inches on each side. Now straighten the ends and slip them into the place occupied by the core, then twist the clamps back, closing up the rope, taking out any slight inequality with a wooden mallet. Next, shift the clamps, and repeat the operation at the other five places, and the splice if made.

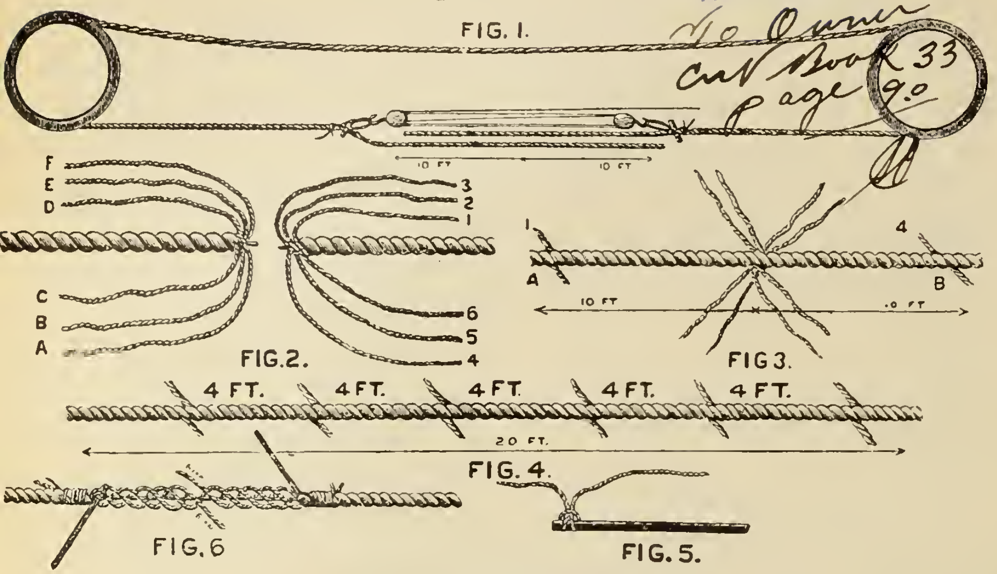
Long-Running Splices.

If the rope becomes slack in time and runs too loose, a piece can be cut out and the rope tightened up. This will require a piece of rope about forty feet long and two splices, one splice to put

on the piece of rope, and the other splice to join the two ends together.

The splices for running ropes are all of the kind known as the long splice, and should be put in twenty feet long. The size of the rope is not increased or diminished, or the strength of the rope perceptibly weakened by this splice, and after it has been run for a day or two the locality of the splice cannot be detected by the most careful examination.

Showing Detail of Rope Splicing.



The diagram of splices fully illustrates the manner of splicing in all its stages, from beginning to end, and by a little study of these diagrams and carefully following the directions, any man of ordinary genius can make a successful splice on first trial.

To Get the Length of Rope to Be Spliced Endless.

The B. Greening Wire Co., Hamilton, can furnish ropes ready spliced by giving the exact distance from centre to centre of shaft, and the exact diameter of wheels on which the rope is to run. This measurement can be got best by stretching a wire from shaft to shaft, marking the distance from centre to centre of shaft, and carefully measuring the wire.

CROSSLEY PETROL ENGINE.

THIS engine is made by Messrs. Crossley Bros. of Openshaw, England. The illustrations show tranverse and longitudinal sections, with an end elevation and plan. One of the most striking features of the engine is the valve which varies the volume of the charge drawn into the working cylinders. A reference to figure 5 will show that the inlet-valves, A, and the exhaust valves, Ag, have their seats arranged on a some-

and that the gases therefore tend to pass more equally around them, instead of on the cylinder side only, this being

what lower level than the port leading from them into the working cylinder, particularly important for the exhaust-valves, because it reduces the tendency for the valve to be heated to a greater extent on the one side than the other.

The cylinders and their pistons are made of hard cast-iron, and their exact shape is shown in figs. 1 and 2, where also the hollow gudgeon pins and the the connecting rods are shown sectionally and in elevation.

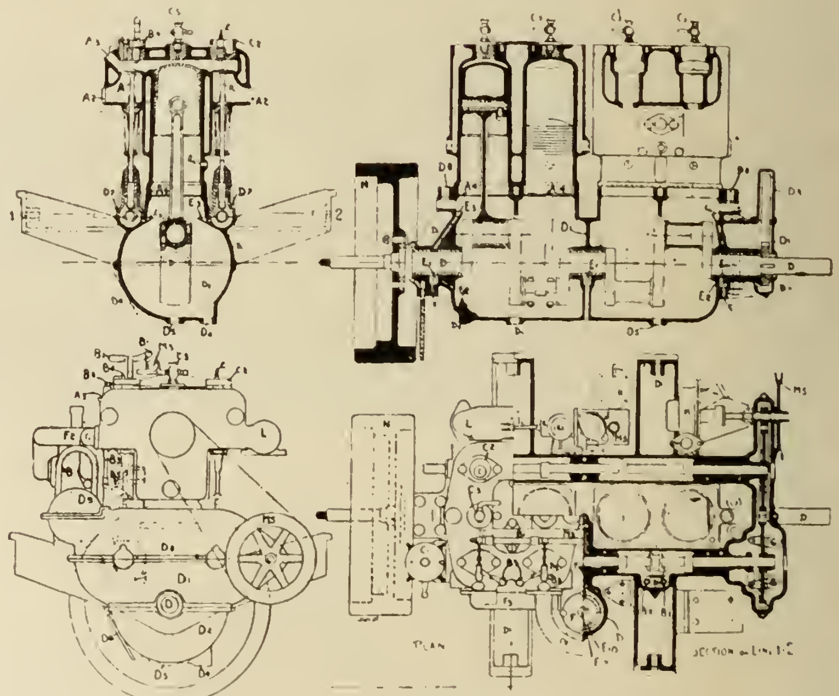
The crank chamber is so shaped that it encloses the lower portion of the gear wheels drawing the cam shafts, and a separate casing, D3, completes this casing.

The crank shaft, D, is made of nickel steel, is machined all over from a forging. Messrs. Crossley have adopted the special system developed by them for their ordinary gas-engine crank shafts, for this four-throw crank shaft. The fly-wheel, N, is fixed to the crank shaft by bolts passing through a registering flange, which forms a part of the solid forging. The igniters, B4, are operated by the disc-cams, two of which are seen on the inlet cam shaft in fig. 8, these cams engaging with projecting arms mounted on the lower ends of the vertical rock-shafts, B3. The time of ignition is varied by raising or lowering the rock-shafts, B3.

The governor, G, is fitted inside the large spur-wheel which drives the inlet cam shaft. It is of the ordinary centrifugal type.

The engine is capable of working at any speed between 80 and 1,200 revolutions, this wide range being due to the specially designed carburetter.

Fig. 1 herewith shows vertical cross section through one of the cylinders. Fig. 2 shows vertical longitudinal sections through centre of engine. Fig. 3 is a front elevation. Fig. 4 is a part plan and part horizontal section through cam shaft.



Crossley Petrol Engine.

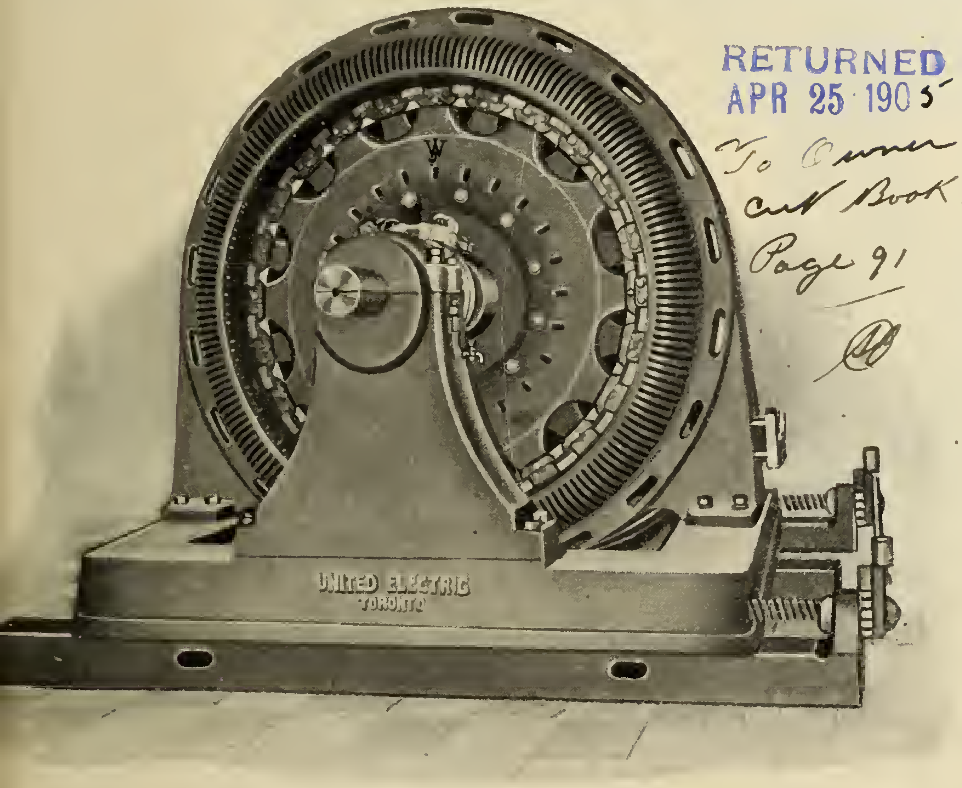
A weighing machine, said to be the most powerful in the world, is being made in Birmingham. It is capable of registering a load of 220 tons.

A NEW ELECTRIC GENERATOR

By William Asahel Johnson, Toronto.

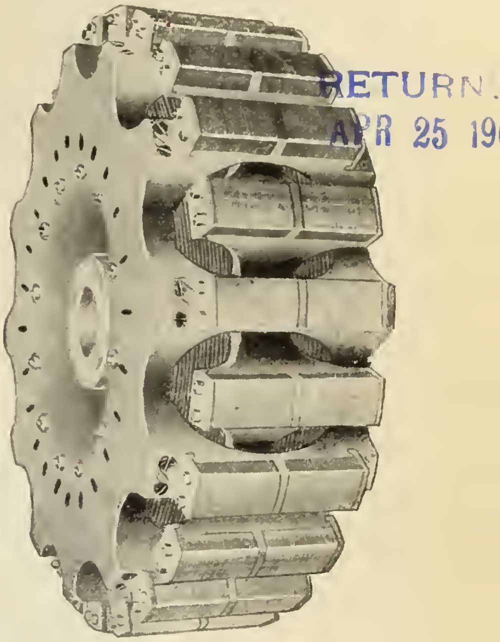
THE alternating current generator of the revolving field type, herein described, is considered by the writer and admitted by parties who have investigated and noticed the machine in operation, to be a decided advance in dynamo design. The claim is made that this generator is superior in regulating qualities, in efficiency, and operates at a far lower temperature than generators of the old type. The type of revolving field adopted by the largest manufacturers in America and Europe is simply the multipolar field common to all commutating or direct current machines. Such construction has been in vogue for the last 15 years, during which period at least there have been brought out no designs having novelty or showing a new theory or principle of magnetic design. Aside from Tesla's motor one is practically justified in saying there have been no new distinctive types of electric machines placed on the market during an even greater period, as the patents issued have covered mere details of design such as various devices for regulation, designs for laminating the frame or rotor, etc., etc., but no material or basic invention.

Cut No. 1 gives an end view of this generator and shows also a short circuited winding, which in this instance was used to give the machine self-starting ability when intended for use as a synchronous motor. That is, under light load the machine can be directly thrown on the line as an induction motor, and when up to the speed the field can be excited and thereafter operate as a synchronous motor. This auxiliary winding would also be of use where two or more generators are run by separate engines and intended to be operated in parallel, as they would keep in synchronism better at any reasonable change in speed of the engine. This digression from the main question, i.e., the new field, may be excused as this construction readily admits of this special short circuited winding and without very material increase in expense of construction. The writer desires to state, however, that such extra winding is not essential to his machine when used as a generator, but simply adds extra qualities when used as either a generator or synchronous motor, and such extra qualities are not so readily to be obtained in the other usual design mentioned in the first part of this article.

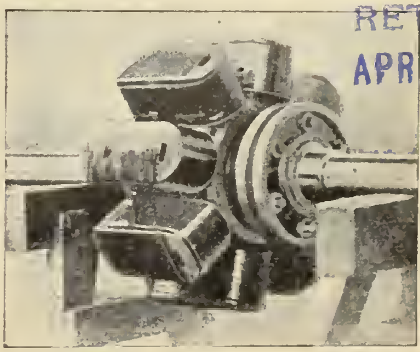


No. 1—New Revolving Field Alternator. W. A. Johnston Patent.

The new rotating field is shown in cut No. 2. The field may be mounted on horizontal or vertical shaft to suit the driving power. The radical and novel change in design will be readily seen by examining cut No. 3, which shows the old or usual type or revolving field. It can be readily seen that inasmuch as the function of the rotor (the field or primary) is, 1st, to provide the magnetic field, and 2nd, to vary the position of the flux flowing from the primary as relating to the armature (the secondary):—that the field electric (the copper winding) and magnetic (the iron) circuits are in a better balanced position as regards the inductive action taking place between field and armature than in any alternator yet designed. The magnet system of any generator controls the generation of the current, in fact, the magnets are the prime and essential feature of a generator, and yet the armature has been commonly looked upon as the chief point, and so common has been this habit that the armature has hitherto chiefly received the best thought and efforts of electrical people; but there is no getting over the fact, the magnet system in an electric machine is, and always will be utterly indispensable and the greater the perfection of its design and the stronger and more constant the flow of the magnetic flux from



No. 2—New Revolving Field.

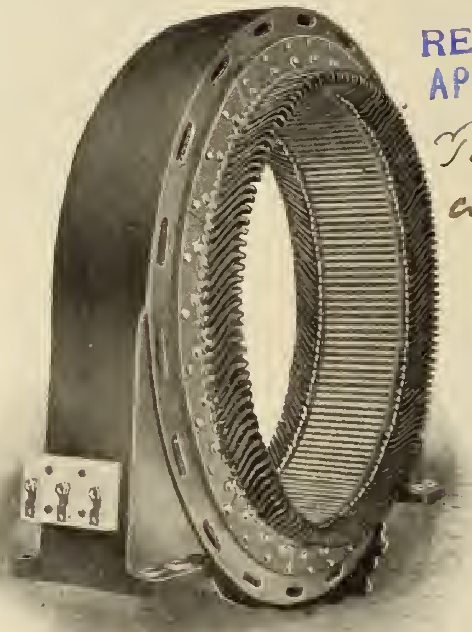


No. 3—Old Style Field

its polar faces, the more efficient the generator and the more constant the electro-motive force generated, and all this depends upon the definite alignment of the magnetic poles by the establishment of an unchangeable neutral line that is a line of zero potential. Absolute regulation and a cool and efficient machine are the ends aimed at. The construction herein described achieves these desirable objects.

The regulation obtained is practically as close as in static transformers. Why? Because there is a definitely aligned and unchanging line of zero potential dividing the magnets and their inductive effect upon the armature, as absolutely unchangeable as the inequalities of the iron and the reversal of di-

that is under its normal field excitation, that the testing of the generator under full magnetic saturation will develop the maximum capacity of the generator; that is, such a test made at the factory establishes the normal and the overload capacity beyond dispute. Generators built under the writer's patents can be short-circuited by means of oil switches under full voltage up to and even beyond 10,000 volts. The above circumstances of regulation indicate that armature reactions against full field need no longer prove a bug-bear, that induction motor loads can be handled in connection with lighting load with satisfactory results. By using the same construction in motors as used in the generator, but with the addition of



No. 4—Armature.

rection of flow, in the armature circuits will admit of, when using the common type of armature as used in the present construction. (The writer's patent claims, by the way, to cover an armature construction carried out on identical lines to that of the field herein more particularly described.) So perfect is the regulation that the circuits of the armature may be short-circuited under full excitation of the field and the armature current not rise more than 10 per cent. above normal or such other rise as may be pre-determined by the designer, whereas in the old type if the armature terminals are short-circuited at much above one-half full field, then the result is an over-heated machine up to the point of destruction under full field. It immediately becomes apparent that if a generator can be short-circuited when generating its rated E.M.F.,

the short-circuited bar winding for self-starting, these machines allow of the highest possible power factor under all load conditions. The generator or motors are interchangeable, i.e., the generator can be used as a commercial synchronous motor or generator at pleasure under the most favorable conditions. Again referring to cut No. 2, it will be noted that the field coil (of which only two are used regardless of the number of poles) are wound concentric with the shaft in the line of mechanical motion, and therefore the mechanical placing of the coils is facilitated. The method of building up the rotor has been much simplified in later construction, than as shown in cut. As now built, the field coils are very easily accessible.

As above stated, the armature construction (see cut No. 4) as herein de-

scribed, is practically identical with other well-known makes, and is no better and no worse than theirs in any respect, using equally good material and workmanship.

As to temperature. The armature re-actions common to the older types, which necessarily cause counter action and again re-action and so on in endless confusion between field and armature, are herein eliminated as in no other construction, consequently the temperature of the iron is extremely low, not 50 per cent. of the rise under similar conditions of size and output of other types; in fact, the heating of the entire machine inside the limits of carrying capacity of the copper and magnetic saturation, and aside from the unavoidable eddy currents of the iron can be considered as negligable.

The air gap between polar faces and able eddy currents of the iron, can be ehanical clearance may require, and not so excessive as the older type. The efficiency is therefore very high.

At first thought it may be contended that the copper winding of the field might require to be heavier, but this is counterbalanced by the decrease of the air gap and the peculiar qualities of the field, which allow a heavier exciting current without correspokding increase in temperature for same capacity in the copper. The good regulating qualities of this machine do not end at the terminals, as it is a well-known fact that all reactions within the generator are reflected in the circuits, and instead of a smooth current in the line the contrary is the usual case with the old type, and the results are shown in the static discharge and broken down transformers.

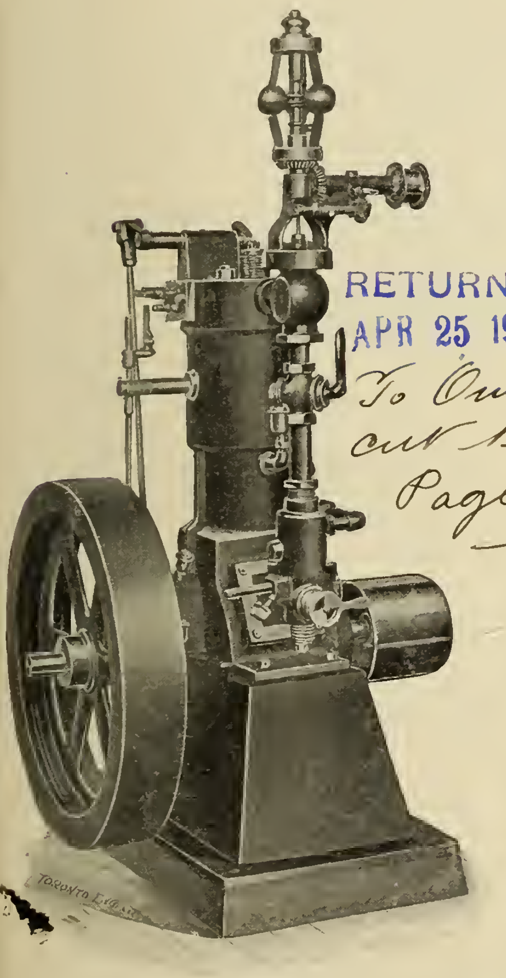
The writer feels warranted in making the statement that it seems impossible to build an electric machine with more than two or less than two energizing coils and get the highest results, and as he has designed, built and been granted patents in various countries for inductor alternators and commutating machines embodying this same principle, he knows that the rule works not only both ways but three ways, that is, in the three commercial machines universally manufactured—the revolving field alternator the inductor alternator and the direct current multipolar dynamo.

As regulation means you can use efficient lamps, and on account of the economical generation of the current within the generator, the writer is prepared to undertake contracts for this construction with a guaranteed saving in operation to the purchaser of from 10 to 15 per cent. on the cost of generating plant.

Negotiations are under way for the manufacture and sale of these machines where patents have been granted to the writer, the inventor, and they are now manufactured by the United Electric Co., Limited, of Toronto.

GASOLINE ENGINES.

SERIOUS misgivings exist in the mind of the general public as to the degree of perfection to which the gasoline engine has attained, many believing that it is yet nothing more than an experiment. This idea is erroneous. As in other lines of manufacture, there have been failures; but the present remarkable degree of success which these engines have reached has been attained by taking advantage of modern science relating to this force, and by utilizing the most improved mechanical appliances and by intelligently experimenting, which has cost thousands of dollars and years of continued trying.



McLachlan Vertical Stationary and Marine Engine.

Feature of the Gasoline Engine.

The feature about a gasoline engine which gives an impression that it is a complicated machine is the train of gearing used for driving the valve motion. When it is understood just why this gearing is required, and what purpose it serves, the impression of complication disappears, as gearing in itself is one of the oldest and most familiar elements of machinery. In order to make the utility of train of gears apparent, it is necessary to consider what takes place in the cylinder. As the gas must burn in the enclosed space between the piston and the cylinder head, it must first be mixed with such an amount of air as will furnish sufficient oxygen for its rapid and complete combustion. If the air supply be too little, the gas is not all consumed, and the economy is thereby seriously impaired, and if the air supply be too great, the quantity of gas used per stroke is reduced, resulting in lowering the capacity of the engine.

Cycle of Operations.

The piston being at the top of its stroke and moving downward, draws in a cylinder full of the mixtures of gas and air. On the return stroke this charge is compressed into the clearance space between the top of the piston and the cylinder head. The smaller this clearance, and consequently the higher the compression, the more efficient the engine, the reason being that with a measured quantity of gas, such as is contained in a cylinder full of the mixture, the smaller the space in which it is burned the higher will be the pressure generated, and the smaller the initial volume of the products of combustion under the high pressure, the greater number of times they will be expanded in following up the piston to the end of its working stroke. A high initial pressure, coupled with a large ratio of expansion, has a more important effect on the economy of a gasoline engine than of a steam engine, because in the former we do not have to contend with the phenomenon of cylinder condensation which, in the latter, offsets the gain from expansion when carried beyond certain limits.

While there is no theoretical limit to the extent to which compression might be carried with corresponding increased efficiency resulting, there is a practical limit at which we must stop, for the reason that when this is passed the heat generated by compression will cause the mixture of gas and air to ignite spontaneously. This would be fatal to the operation of the engine, as in order to secure good results we must be able to control the ignition and time it accurately, having it occur just as the piston is ready to begin the next succeeding stroke. Premature and spontaneous ignition cause pounding, reduction of speed and power, and may even cause a complete stoppage.

The piston having reached the end of its compression stroke, the charge is ignited by the spark formed by opening an electric circuit in the clearance space, in some cases, and by a hot tube in others. The air and gas being thoroughly mingled in the right proportions, combustion takes place with such rapidity that it may properly be called explosion, and the resulting heat raises the pressure to several hundred pounds to the square inch. The burnt gases under this high pressure expand, driving the piston on its working stroke, and are expelled through the exhaust on the return stroke, which when completed brings all parts of the engine in position to repeat the same cycle of operations.

McLachlan Threshing Engine.

From the general explanation of the cycle of operations occurring in the engine, it will be seen that during one revolution it acts as a pump to supply itself with fuel, which it utilizes running as a single-acting pressure motor during the next succeeding revolution. The valves and the igniters pertaining to each cylinder have, therefore, to perform their functions once for every two revolutions of the crank, instead of once for every revolution, as in the steam engine; consequently the cams which operate these parts—cams being used in preference to eccentrics by reason of their more prompt action—must be mounted on shafts running only half as fast as the main shaft; and spiral gears are the only positive means by which this reduction of speed can be made, and this is the sole object of their introduction.

The McLachlan types of gas and gasoline engines employ a mixture of gas and air of unvarying quality, initially proportioned according to the nature of the gas used in order to secure the maximum efficiency under all conditions.

ABOUT CATALOGUES

Any Catalogue spoken of on this page will be sent upon request. Kindly mention Canadian Machinery

L. E. Rhodes, Hartford, Conn., are sending out a pamphlet describing their 7-in. bench shaper.

The Loew Adjustable Die Stock is described in a booklet issued by the Loew Supply & M'f'g Co., Cleveland, Ohio.

The American Air Compressor Works issue a booklet containing valuable information regarding compressed air installation.

The Pigeon-Hole is a monthly publication by the Peerless Electric Co., Warren, Ohio, describing the features of the Peerless Motors.

Niles-Bement-Pond Co. send their catalogue describing in detail the high-class horizontal boring machines manufactured by them.

"Bundy Steam Traps" is the title of an illustrated treatise dealing with the manufacture of A. A. Griffing Iron Co., Jersey City, N.J.

A cloth-bound catalogue, fully indexed, describes the machine tools manufactured by the Newton Machine Tool Works, Philadelphia.

Dewhurst Slag Ladels and Cars are well illustrated and described in a booklet sent by the Wellman-Seaver-Morgan Co., Cleveland, Ohio.

Packard Electric Co., Limited, St. Catharines, Ont., in Bulletin No. 21, describe in detail the Jandus series Alternating Arc Lighting System.

Bulletins describing drilling machines, portable forges and bolt-cutting machines, have recently been issued by Boynton & Plummer, Worcester, Mass.

Becker-Brainard Milling Machine Co., Hyde Park, Mass., illustrate and describe different types of milling machines and grinders in circular No. 50-13.

An interesting booklet has been sent by the United States Register Co., Battle Creek, Mich., who are represented in Canada by the Jones Register Co., Toronto.

Norton Plain Grinding Machines, as manufactured by the Norton Grinding Co., Worcester, Mass., are described and illustrated in their catalogue of recent issue.

"More Starrett Tools" is a supplement to catalogue No. 17, of the L. S. Starrett Co., Athol, Mass., describing some recent tools introduced by this company.

Medium Blowers and Exhausters are fully described in a neat catalogue just issued by Sheldon & Sheldon, Galt, Ont. Dimensions and capacities are tabulated.

"Points on Packing" and "Valve Troubles" are two interesting little booklets containing considerable information recently issued by Jenkins Bros., New York.

A. D. McArthur & Co. are sending out catalogues describing high-class gas and electric light fittings manufactured by Charles Joiner & Co., Limited, Birmingham, Eng.

Vertical Milling Machines are fully described, together with numerous applications, in catalogue No. 53, issued by Becker-Brainard Milling Machine Co., Hyde Park, Mass.

A pamphlet from the Pittsburg Machine Tool Co., Alleghany, Pa., describes their 48-inch engine lathe, which embodies the late improvements in lathe construction.

Heavy Duty Steam Shovels is the subject of a small book issued by the Vulcan Iron Works Co., Toledo, Ohio, describing the mechanical construction of their steam shovels.

An 80-page catalogue, issued by Robt. Jenkins & Co., boilermakers, Rotherham, Eng., describes the different styles of boilers for heating and power purposes made by them.

Kewanee Fire Box Boilers are described in a booklet issued by the Kewanee Boiler Co., Kewanee, Ill. This booklet gives data of the measurements of different styles of boiler.

The Henderson Roller Bearing M'f'g Co., Limited, Toronto, are sending out a pretty calendar showing up-to-date cars and automobiles equipped with Henderson Roller Bearings.

The Pneumatic Department of the Canada Foundry Co., Limited, have issued Bulletin No. 26, which describes standard types of air and gas compressors manufactured by them.

Boynton & Plummer, Worcester, Mass., have issued a 116-page catalogue, including price list, of their improved shaping machines, upright, hand-power drills, tapping machines, etc.

The McLachlan Gasoline Engine Co., Toronto, Ont., have just issued a descriptive catalogue of their gas and gasoline engines, including traction, stationary, portable and marine.

The Kempsmith Miller is fully described in an attractive catalogue issued by the Kempsmith M'f'g Co., Milwaukee, Wis. The different parts and attachments are also described in detail.

Catalogue No. 90, issued by Wilmarth & Morman Co., Grand Rapids, Mich., describes the New Yankee Drill Grinder, also friction counter shafts, arbor presses, and the Nelson loose pulley.

The Wizard Engine, manufactured by the Olds Gasoline Engine Works, Lansing, Mich., is described in detail, with illustrations of the different parts, in a catalogue just issued by this company.

A comprehensive book, pocket size, 141 pages, has been issued by the Scully Steel & Iron Co., Chicago, being their latest stock list, giving information regarding boilers, machinery, tools, etc., carried by this firm.

"Pioneers and Leaders" is the title of a handsome catalogue issued by the New York Belting and Packing Co., Limited, showing the progress of this company after over sixty years of activity.

Acetylene Stove Co., Minneapolis, Minn., issue a booklet describing the different styles of acetylene lights and generators, with a discussion on the merits of acetylene versus other sources of light.

The Tripp Metallic Packing, manufactured by Wm. Demerill & Co., Boston, Mass., is described in an interesting manner in an illustrated booklet, which also contains data on dimensions of valves, etc.

The Norton Emery Wheel Co., Worcester, Mass., are sending out a 167-page catalogue describing their emery and corundum wheels, grinding machinery, with prices and data regarding their output.

A catalogue of the Wellman-Seaver-Morgan Co., Cleveland, Ohio, illustrates and describes the Dewhurst Patent Slag Ladles and Cars, and mentions a number of users of these cars in Great Britain and India.

The Wadsworth Improved Core Machine, manufactured by the Falls Rivet & Machine Co., Cuyahoga Falls, Ohio, is described in a catalogue issued by them. This firm are core and core machine specialists.

Woodman's Patent Railroad Ticket Punchers are illustrated, together with the different makes of punchers, and shapes of punch, manufactured by R. Woodman M'f'g & Supply Co., 63 Oliver street, Boston, Mass.

The Stanley Rule & Level Co., New Britain, Conn., issue a reference book containing valuable information to mechanics on rules, plumbs, and levels, planes, squares, bevels, braces, and miscellaneous wood-working tools.

"The Machine That Does the Work of Twenty Clerks," is a striking title of a catalogue issued by the Rapid Addressing Machine Co., 290 Broadway, New York City, in which their rotary addressing machine is fully described.

"Vertical Milling Machines" is the title of a neat catalogue No. 53, issued by Becker-Brainard Co., Hyde Park, Mass. It describes in detail these machines, and illustrates some different styles of work being done by the machines.

Marine engines, built by Thermaat & Manahan Co., Oskosh, Wis., together with the different parts and principles of operation, are described in their recent catalogue. These engines are designed particularly for small boats and launches.

"Twist Drills — Their Uses and Abuses," is the title of a neat booklet issued by the Cleveland Twist Drill Co., Cleveland, Ohio. This booklet contains valuable information on the subject. Every machinist should have a copy of this.

Catalogue No. 81, illustrating rock drill, mining and tunnelling machinery of the Ingersoll-Sergeant type, has been issued by Allis-Chalmers-Bullock, Limited, Montreal. It describes these drills and gives illustrations of numerous practical applications of work they are doing.

The following bulletins have been received from the Canadian Westinghouse Co.: No. 1094, describing Westinghouse alternating current turbine type generator; 1096, describing oil switches and oil circuit-breakers; 1097, describing type K motors direct-current series, wound for crane, hoisting and similar service; 1098, describing Westinghouse switch-board indicating instrument; 1099, describing Westinghouse bi-polar motor.

Machinery Development

Metal Working **Wood Working**

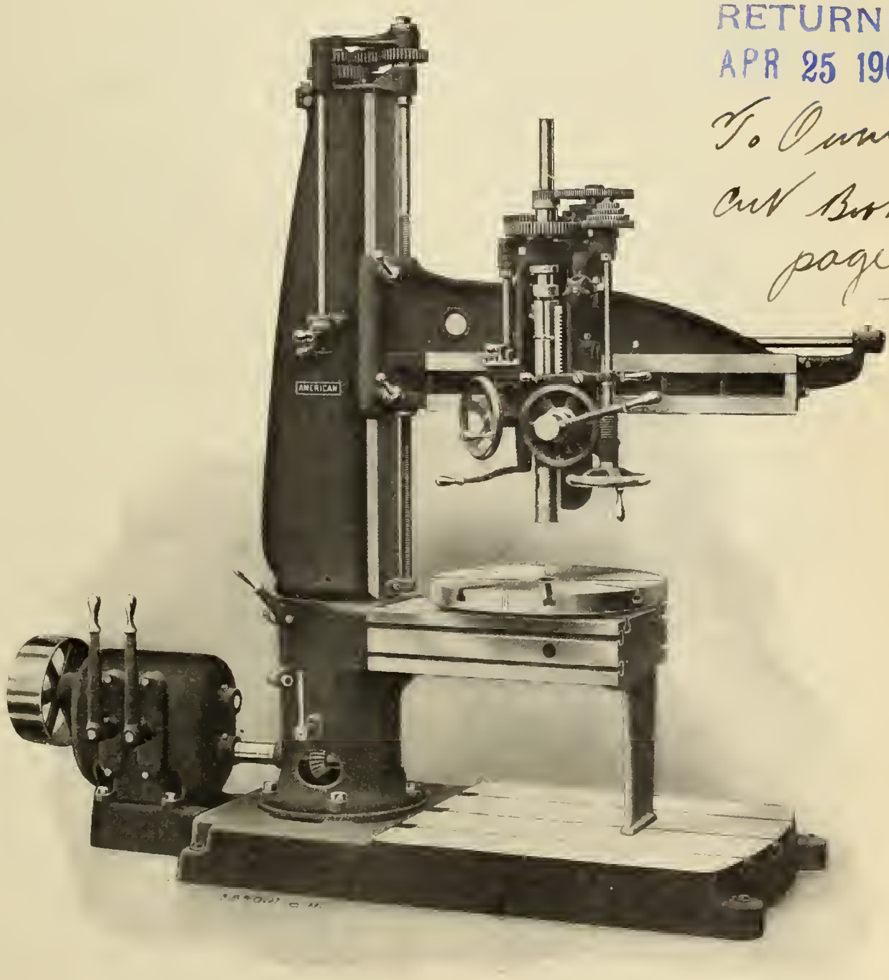
THREE-FOOT ARM COMBINATION RADIAL DRILL.

In order to meet the changed conditions and greatly-increased duties now imposed upon machine tools, consequent upon recent developments in modern shop practice, the American Tool Works Co., Cincinnati, have completely re-designed their entire line of radial drills, taking into full account every condition influencing modern radial work, and every point which would tend to increase their efficiency.

Feeding mechanism on the head provides four distinct rates of feed covering a carefully chosen range, in geometrical progression, from .007 in. to .041 in. These feeds are all readily obtained by the simple turning of a dial on the feed box until the desired feed, indexed thereon, comes opposite a fixed pointer. This method of feed change is by far the simplest yet devised, as it requires no reference to index plates and subsequent handling of levers. The all-gear feeds, when supplied instead of belted feeds, insure vastly increased productive capacity, rapidity of change, and positive action.

Depth gauge and automatic trip.—Feeds can be automatically tripped at any position of spindle by adjustable trip dog and pointer, acting on the worm clutch. Depth graduations are on the spindle, and all depths can be read from zero.

Speed box is of the geared friction type providing four changes of speed, each being instantly available by use of the two levers shown. Frictions are of our patent double band type, employing very few parts in their construction, which can thus be made of such large proportions as to be free from slippage under the severest cuts, and obviating the use of loose delicate parts, a source of frequent breakage on most other makes of radial drills. A motor of any type may be readily attached at any time, connection being made through chain, gear or belt. The speed box can be easily interchanged with a cone by simply breaking a coupling connectionion the lower driving shaft of the machine. Spindle has eight changes of speed, ranging from 13 to 300 in geometrical progression, all immediately available without stopping the machine. This wide range of spindle speeds, combined with the exceptional driving power of the machine, renders the drill equally efficient with either ordinary or high-speed twist drills. Spindle is regularly bored for No. 4 Morse taper hole. Column is of box girder type, revolves in a stationary stump carrying conical rollers, and is clamped securely in any position by means of a lever near the foot. Thus it is in effect, and has all the good qualities of a round column, capable of treme reach of spindle. Arm is clamped to column by binder levers, obviating loose wrenches, and is raised and lowered rapidly by a double thread coarse pitch screw, hung on ball bearings, and controlled instantly by a convenient lever. Head is moved rapidly along the arm by hand-wheel through spiral pinion and rack, the hand-wheel being located on head directly at hand of operator.



3-ft. Radial Drill.

being swung in a complete circle unless arrested by belt, if driven from overhead, a very desirable feature. Arm is of parabolic beam section, strengthened along top and bottom lines by circular section, giving great resistance to bending and torsional strain. Its design leaves the lower line parallel with the base, and thus permits work being operated upon in close proximity to the column without the necessity of an ex- Back gears are located on the head, the only proper place for them, thus bringing the greatest speed reduction direct to spindle. They may be engaged or disengaged without shock or jar while the machine is in operation.

Spindle is counterbalanced and has quick advance and return. Note that all operating levers are controlled by operator at front of the machine, and within easy reach. Tapping mechanism is car-

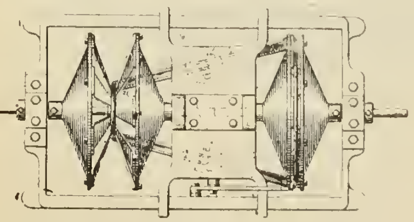
ried on the head, between the hack gears and speed box, thus giving to the frictions, already very powerful, the benefit of the back gear ratio, making unusually heavy tapping operations possible, and also permitting taps to be backed out at an accelerated speed. The lever for starting, stopping, or reversing the spindle, is controlled at the head from the front of the machine.

Base is of massive proportions, strongly ribbed, in fan shape, radiating from column, making a particularly rigid base. Is accurately planed, and has large T-slots with an ample allowance of metal around them. Plain table has top surface of 16 in. x 26 in., and also side surface, the latter giving the equivalent of an angle plate. Both top and side surfaces are accurately planed and supplied with large T-slots. Worm swiveling table can be revolved to any angle horizontally, through worm and worm wheel. It is graduated in degrees at point of swiveling contact, and can be readily set to permit a hole being drilled at any angle within range. The top surface is 16 in. x 24 in. Round table is 24 in. diameter, and may be fitted to either the plain or worm swiveling table, as illustrated. It revolves by hand on stump fitted into other table, and is thus very convenient for jig drilling. It can be securely locked by binding screw. Regular equipment, upon which price is determined, consists of the machine with cone pulley drive, plain table only and countershaft. No wrenches are necessary.

VARIABLE SPEED AND POWER TRANSMISSION DEVICE.

THE accompanying illustrations show a speed-varying device employing extensible pulleys, wherein each portion of the pulley has arms forming part of a conical surface and engaging between similar arms on the opposed portion of the pulley.

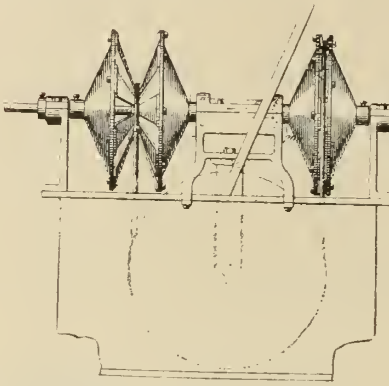
Two extensible pulleys are arranged on the separate shafts placed end to end and mounted in a convenient frame-



Plan of Variable Speed Device.

work. The adjacent ends of the shafts are carried in a movable bearing, this bearing being arranged to slide on the framework and is controlled by a lever or other suitable means. Below the central sliding portion suitable guide pulleys are mounted in swiveling supports, the pulleys being adapted to carry an endless rope, belt or chain belt transmitter passing from one of the expanding pulleys to the other.

One member or portion of each extensible pulley is, of course, secured on its shaft, while the other member is free to slide on the shaft during the ad-



Elevation of Variable Speed Device.

justment. The arrangement is such that when the shafts are revolving, a movement of the lever which shifts the central bearing brings together the portions of one pulley while separating those of the other, and silultaneously moves the guide pulleys so that the opposite points of the circumference of the guide pulleys remain in line below the working grooves in the extensible pulleys.

It will thus be seen that by moving the lever in one direction or other, the relative speeds of the two extensible pulleys, and consequently of the shafts on which they are mounted, may be varied at will within wide limits and as gradually or quickly as desired. The end thrust, due to the pressure of the transmitter, is taken up by ball bearings. The tension of the transmitter is regulated automatically to suit the load. This style of apparatus takes up very little space, is claimed to be very efficient, noiseless in operation, and can be built to transmit any amount of power and to give any desired ratio of speed variation. The inventor is C. L. Rosenquist, Niagara Falls, N Y.

NEW UNIVERSAL SURFACE GAUGE.

THIS gauge has the latest improvements of the L. S. Starrett Co., Athol, Mass., the following being points of special merit:

It has a heavy base, grooved through the bottom and end, adapting it for use on or against circular work as well as flat surfaces. The spindle passes through a rotating head, joined to a rocking bracket, pivoted in base, the bracket being adjusted by a knurled screw in one end against a stiff spring in the other. The spindle may be set upright or at any angle, or turned so as to work under the base, and can be sensitively adjusted to any position. The snug and head carrying the scriber are so made that when the clamp nut is loosened all may be freely moved to any position, and by friction springs retained in place until a slight turn of the clamp nut holds them firmly.

In the base are four gauge pins, frictionally held, which may be pushed to bear against the edge of a surface plate, or in the slot of a planer bed for lineal work.

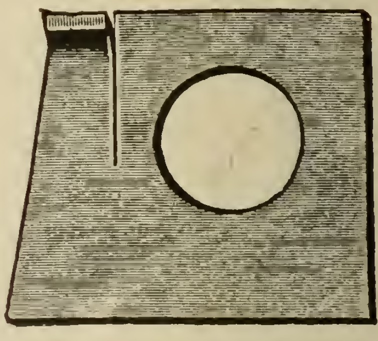
For small work the spindle may be removed and the scriber inserted in a hole provided for it, where it can be sensitively adjusted and used to advantage on bench work.

Special attention is called to the four gauge pins in the corners of the base, which adapt it to be used as a locomotive guide liner and make it more convenient than other gauges for many uses.

An extra long spindle, which may be quickly substituted for the regular, will be sent with the gauge when ordered.

A NUT LOCK.

A NEW device for locking nuts, which has been on the market but a short time, is illustrated herewith. The device as is seen by the illustration is not large and lumbersome, but flat, it being manufactured out of a piece of mild steel. The use of this lock does away with the need of the pin, the extra nut, that is sometimes used, and washers. It also saves time for the bolt manufacturer, inas-



A Nut Lock.

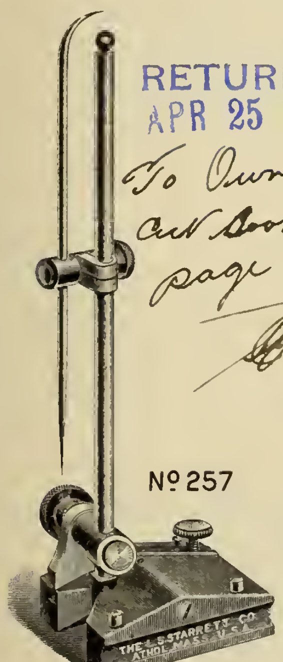
much that each bolt does not need as much threading. The nut is so tightened on the bolt, which appears through the circular opening, that one of its edges agrees with the edge of the opening between the tongue and the main piece of the lock. This being obtained, the tongue is then bent downwards by means of a hammer or some other heavy object, till it rests against the side of the nut, thus preventing it from turning. Although the article has been on the market but a short time, large orders

have been received from railways and manufacturers of electric and other kinds of cars. Mr. Whitesall, at No. 22 St. John street, Montreal, is agent for this new lock.

VERTICAL MILLING MACHINES.

THREE of the machines manufactured by the Becker-Brainard Co. and installed in the Canadian Westinghouse Co.'s plant are herewith illustrated. They include their No. 3 Vertical Milling Machine, No. 5 Vertical Milling Machine, and Profiler. The No. 3 milling machine is desirable on small job work and light milling operations. It is adapted for obtaining extraordinary high spindle speed when using small end mills. The No. 5 machine is designed to do heavier work.

The vertical movement of the head is



New Universal Surface Gauge.

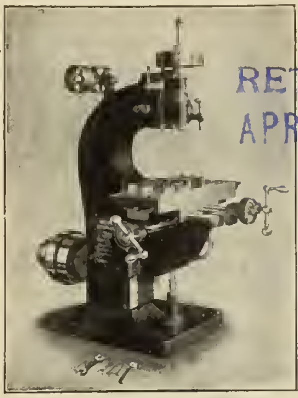
controlled by a hand wheel. The foot lever is, however, provided instead of the hand wheel, when the machine is to be used for fine die-sinking purposes, thus enabling the operator to more conveniently manipulate the vertical movement of the spindle. For drilling and boring, the hand wheel is preferable to the foot lever and is usually furnished unless otherwise specified.

Stop gauge with micrometer readings is attached to the head to regulate the depth of the cut.

The spindle is hardened at main bearing , and finished by grinding. It is adapted for use with split collets which are rigidly secured by a draw-bar passing through the centre of the spindle.

The boxes are made of bronze and provided with means of adjustment.

Steel-faced gripping jaws are furnished with each machine. These are made to work in combination with the T slots



Profiler.

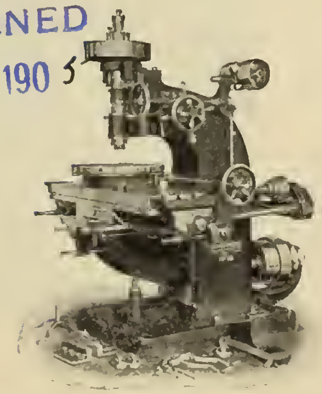
of the main table. Length of jaw, 8 in.; depth, 2 in.; length of piece that may be held between jaws, 15 in.

Hand rotary attachment is usually furnished with graduated table provided with T slots. When machine is to be used for die-sinking, a four-jaw chuck can be supplied in place of circular table, or both may be provided interchangeable with each other at additional cost.

Feeds are derived from compounded gears, giving six changes for each change of spindle speed.

The No. 5 is a micrometer stop-gauge at the upper left-hand side of the head which accurately gauges the depth of cut in addition to the features of No. 3.

This No. 3 Profiler is similar to No. 3 Vertical Miller, but is provided with rack and pinion feed in place of the usual screw feed, and is designed for light work when quick action is desirable, as when operating upon brass and where the machine is to be used for copying purposes.



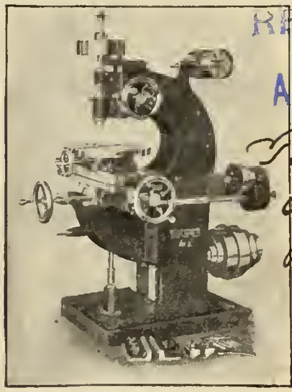
Vertical Milling Machine.

It is exceedingly well adapted for general use in bicycle shops, gun and screwing-machine factories, and for the rapid duplication of parts in all lines of manufacture.

RADIAL COAL CUTTERS.

SO long as coal remains the basis of industrial progress, any means or method which results in a reduced cost of coal production must be of interest to all branches of productive industry. Machine methods have long held prominent place in the coal mining field and the "puncher" or pick machine is a recognized factor in coal mine economy. But long years of experience with this machine have clearly established its limits of usefulness, and the need of another machine to supplement or assist the "puncher" has long been recognized.

Such a machine is the new Radial Coal Cutter, recently placed on the market by the Ingersoll-Sergeant Drill Co., of New York. While only lately brought before the public, this machine has for a long time been in severe experimental service in some of the largest producing coal mines in the country, and its performance there has aroused the keenest interest among coal mine



Vertical Milling Machine.

operators. The radial cutter is designed especially for the work of shearing and entry driving. The idea of the radial mounting is not new, but as applied to the requirements of coal mining it is a distinct innovation which seems destined to revolutionize certain processes of coal mining, particularly as a means of rapid development.

The economical development of coal properties imperatively demands the use of a shearing machine, but the requirements of the situation were so severe that most devices intended to meet them have been abandoned after discouraging tests. In coal mining catalogues but little has been said, but little information given, on methods of entry driving, on entry-driving machinery, or shearing, drilling, cutting out slate or other bands, and on other economical questions of importance more or less vital to the industry. A machine to meet the conditions properly must be light, simple, durable and economical of power.

It must also be capable of operating with economy of coal, i.e., it must break the coal without producing an unduly large percentage of the smaller sizes.

In operation, the new Radial Coal Cutter has shown itself fully capable of meeting these requirements. It is a perfect combination of all essential factors. As an undercutting machine it is adapted for undercutting headings to any desired depth at a single setting. It will also shear either one or both of the sides of an entry, from the floor of the mine to the roof, to any desired depth at one setting. The drill or cutter being mechanically directed, all these operations are performed without any shock or jar on the operator. The machine is light, and easily and quickly moved and mounted, in this respect also appealing to the man who handles it.

The cut made by the Radial Coal Cutter is 8 feet in depth and diminishes from a width of 4½ inches at the face to about 2 inches at the bottom. The piston and chuck having a rotating movement, the machine can be used as a drill for putting in the holes preparatory to blasting the coal. This same fact is of value in permitting the use of the machine as a rock drill for "brushing" purposes; and the change from a rock drill to a coal cutter, or vice versa, can be made in a moment of time. It can, therefore, be used advantageously, in sinking shafts, driving tunnels in rock, drilling through spars, clay veins, "horse backs," etc. It possesses an adaptability which gives it a value far above that of other machines more limited in their fields of application.

The Radial Coal Cutter practically solves the problem which has perplexed and balked the coal mine operator since coal mining began, the problem of rapid and economical development. By its use entries can be driven in less than half the time required by hand methods or any of the so-called entry-driving machines. Its application in the mine materially increases the percentage of lump coal, as well as adding to the output per miner. In mines where the coal is blasted from the solid this machine may be applied for shearing the rooms in the centre, ready for blasting toward the centre upon "open ends." Being mounted upon a plain vertical column, the radial cutter can be raised or lowered to undercut at any point between roof and floor, and readily applied to slate bands, layers of "black jack" and other impurities, leaving the coal mined clean and ready for the market. These are all points which appeal strongly to coal mine operators; especially to those whose output is large and on whose properties a number of entries are to be driven continuously. The Radial Coal Cutter is the outgrowth of an experience covering the whole period of application of machine methods in coal mining, and it is rapidly winning a secure place in coal mine economies. The illustrations show different operations performed by this radial drill.

VALVE TROUBLES.

VALVE troubles may be due either to defective design, material and workmanship, or to faulty installation, lack of care, or abuse.

While a valve is by no means a piece of delicate mechanism, many users treat it much the same as an ordinary pipe fitting, when by exercising a little care considerable annoyance could be avoided.

Leaking through the seat when closed is the principal and most annoying of valve troubles, and is due to irregularity or unevenness of the seat or disc, which prevents perfect contact. Poor installation, lack of care, or abuse, are usually the cause of this trouble when good valves are used, and as other troubles are of minor importance in comparison, we shall treat of this one only.

To properly install valves, the following practice is recommended by Jenkins Bros., New York. Piping should be cleaned out before screwing together, and if possible the line should be blown out after valves are in place. Unless this is done, loose scale or metal chips remaining in the pipes may injure the seats or discs and cause leaks, requiring re-grinding, re-seating or re-

newal of discs. Red lead or pipe cement should be sparingly used and applied to the pipe only, never to the valve, because if put in the valve it is apt to be pushed inside by the pipe, stick to the seat and cause a leak.

Before screwing on a brass valve do

not remove the bonnet unless absolutely necessary; close the valve tightly to make it as rigid as possible, and use the wrench only on the hexagon next to the pipe end. If used on the other end the strain is liable to spring the valve body and cause leaks, not only in the seat but at the bonnet joint.

If absolutely necessary to remove the bonnet before valve can be screwed on, extra care should be taken not to spring the body or dent the joint. A pipe wrench should never be used for this work, as it not only cuts and disfigures the work, but is apt to crush it.

The best way to loosen a valve bonnet is to hold it firmly by the squares in a good vise, screw a piece of pipe well into the valve end, then give a quick, strong pull on the pipe.

A valve should not be allowed to carry the weight of a line of piping, as this may spring the seat. A hanger properly placed has sometimes remedied the trouble with a leaky valve, which could not be kept tight before its use.

For flanged valves the pipe flanges should be made up true and close, as strains that would not affect an ordinary pipe fitting may spring a seat and cause the valve to leak. Unless fitted with a by-pass, it is best to place globe and angle valves so that the pressure will be underneath the disc when closed.

It is bad practice to use a wrench or bar inserted between the spokes of hand-wheel in closing down a valve. When such means are employed by one not thoroughly familiar with their construction, the seat or disc is liable to be crushed and bonnet or yoke overstrained, and the practice is really dangerous. It is better to remove the bonnet and examine the valve to ascertain the cause of leak.

Valves must be designed and constructed to stand considerable abuse, and although it is commercially important to have them as light as possible, strength should never be sacrificed to lightness. Light-weight valves are more easily injured than heavy ones, and are more liable to give trouble.

No matter how much care may be given to their installation and maintenance, the use of cheap and inferior valves is sure to prove troublesome and expensive, and detract greatly from the efficiency of a steam plant, and in order to insure perfect satisfaction with a minimum of care and attention, valves should be selected of approved merit and reputation, and which are guaranteed to do the work for which they are designed.

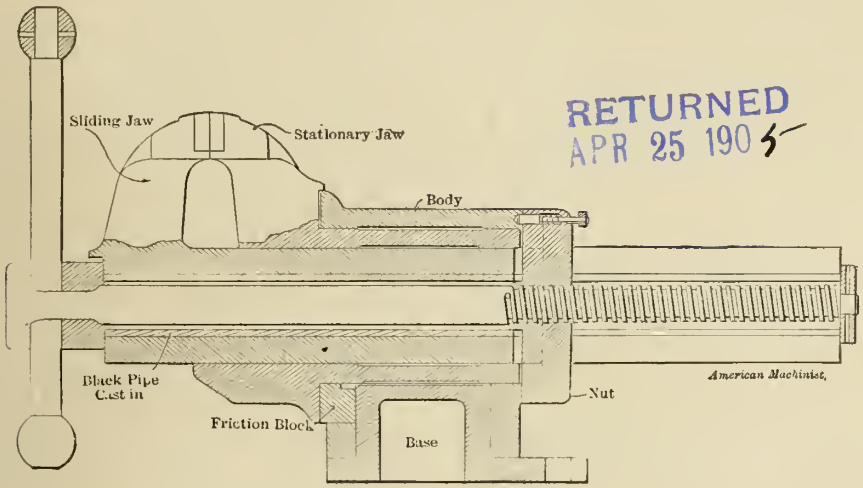


Fig. 1.—Section of Double Swivel Vise.

A DOUBLE SWIVEL VICE.

THE illustrations show a machinist's or toolmaker's vise which may be swiveled in any direction, horizontally or vertically. By referring to the line cut, Fig. 1, it will be seen that there is a friction block bored to the same diameter as the base, and projecting slightly through the body. When a piece of work is clamped between the jaws, the stationary jaw forces the friction block against the base, thereby locking the horizontal swivel. The back jaw does not reach quite through the body, therefore the body is clamped between the nut at one end and the stationary jaw at the other, thus locking the vertical swivel. The jaws are kept in line by the nut, which is the same diameter as the body. The cross-bar which carries the nut passes centrally through a slot in the sliding jaw. As this slot does not run the whole length of the jaw, it does not show in front of the stationary jaw when the vise is full open. Figs. 2 and 3 show the vise in different positions. Both the horizontal and vertical swivels are provided with locking pins, as shown at Fig. 3, but they are merely to maintain a fixed position, the friction clamps being powerful enough to resist any ordinary force. This vise is made by the Reed Tool Co., Erie, Pa.

Some consternation was caused in labor circles early in April when 1,100 men working in the G.T.R. shops at Stratford were laid off. Superintendent of Motive Power Rohh, has since given the assurance that the shops are simply closed for necessary repairs and improvements and the present time, when the heavy work of getting the plant and the rolling stock in shape is well in hand, was chosen as the most opportune to shut down. As soon as repairs are completed active operations will again commence.

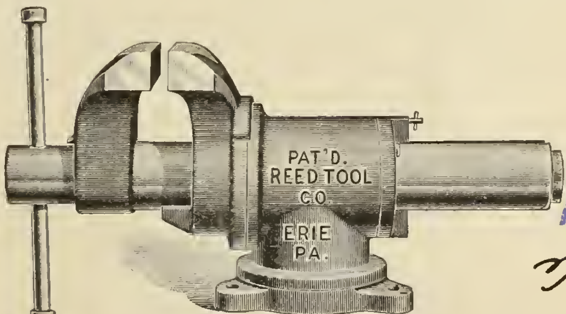


Fig. 2—Double Swivel Vise.

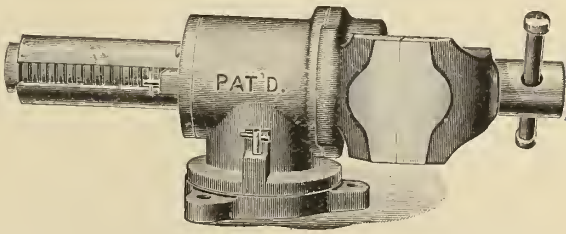


Fig. 3—Double Swivel Vise. Reed Tool Co., Erie, Pa.

Companies Incorporated.

Murphy Iron Works, of Michigan, have been granted power to do business in Ontario with M. C. Huyatte, of Toronto, as its attorney.

Detroit & Dominion Oil Co., of Arizona, granted power to do business in Ontario with A. R. Bartlett, of Windsor, as the company's attorney.

Leamington-Cromber Oil Co., Limited, of Michigan, have been granted power to develop oil properties in Ontario, with A. R. Bartlett, of Windsor, as attorney.

Parkin Elevator Co., Limited, Hamilton, share capital $40,000, purpose to manufacture fire escapes, elevators, etc. The directors are: J. Parkin, A. Winckler, W. A. Gibb and E. Parkin, all of Hamilton.

Harris Oil Co., Limited, Windsor, share capital $100,000, purpose to develop oil properties. The directors are: F. C. Harvey, J. Hartenstein, G. R. Harris, J. C. Goodrich, and H. C. Colborn, all of Detroit.

Colonial Veneer Limited, Toronto, share capital $40,000, purpose to manufacture glue, cement and paint. The directors are: B. D. Cole, H. F. Meylan, T. H. Wilson, A. M. O'Brien, and C. F. Hollis, all of Toronto.

Pittsburg Gold Dredging Co., Limited, Peterboro, share capital $300,000, purpose to develop mining properties. The directors are: W. Hamilton, M. Smith, A. O. Kidd, J. C. Smith and W. H. Munro, all of Peterboro.

Western Development Co., Ltd., Toronto, share capital $1,000,000, purpose to do general developing work. The directors are J. W. Mitchell, R. Armstrong, A. L. Malone, H. M. Asling, and C. W. Fleming, all of Toronto.

Brampton Press Brick Co., Brampton, share capital $50,000, purpose to manufacture brick, cement, etc. The directors are: W. J. Packham, R. J. Packham, J. Packham, J. MacHoover and R. E. Heggie, all of Brampton.

Simplex Engine Co., Limited, Toronto, share capital $50,000, purpose to manufacture steam and gas engines, etc. The directors are: V. L. Rice, H. L. Rogers, G. C. Edwards, A. Allan, and A. H. Edwards, all of Toronto.

Stratford Brick Tile and Lumber Co., Limited, Stratford, share capital $40,000, purpose to deal in building materials. The directors are: C. F. Keller, J. Keller, J. D. Monteith, C. H. Davies, and F. B. Deacon, all of Stratford.

Lee-Hodgins Co., Limited, Pembroke, share capital $50,000, purpose to manufacture incubators, stoves, implements, etc. The directors are: T. W. Lee, G. J. Kitts, Peter White, jr., A. A. White and R. J. Hodgins, all of Pembroke.

Dymond Gas and Engine Co., Limited, Toronto, share capital $1,000,000, purpose to manufacture power machinery. The directors are: V. E. Taplin, Novar, Ont; J. Dymond, A. A. Wighton, C. J. Gibson and R. J. Goudy, all of Toronto.

Walter Nicholls' Motor Boat Co., Limited, Toronto, share capital $25,000, purpose to manufacture motor boats, vehicles, etc. The directors are: W. N. Nicholls, F. Nicholls, A. Angstrom, H. G. Nicholls, and H. H. MacRae, all of Toronto.

Gas Equipment Co., Limited, Brandon, share capital $40,000, purpose to operate gas, water and electric plants. The directors are: D. A. Hopper, K. W. Thompson, G. R. Coldwell, A. Kelly, E. J. Phillips and R. M. Matheson, all of Brandon.

Nanor Automobile Co., Limited, Toronto, share capital $200,000, purpose to manufacture automobiles, motor boats, air ships, etc. The directors are: A. G. Ronan, G. A. Ronan, W. Bullock, E. Ronan, and E. Armstrong, all of Toronto.

Continuous Steel Rail Co., Limited, Toronto, share capital $500,000, purpose to manufacture steel rails, car wheels and railroad supplies. The directors are: F. B. Allan, Wm. McConnell, A. F. Webster, J. M. Smith and C. Bonnick, all of Toronto.

Bellhouse, Dill & Co., Ltd., Montreal, share capital $45,000, purpose to manufacture chemicals, varnishes, cements, metals, etc. The directors are E. F. Surveyor, D. Armour, A. C. Casgrain, S. J. Le Hurey, and K. J. Beardwood, all of Montreal.

St. Lawrence Waggon Co., Ltd., Montreal, share capital $75,000, purpose to manufacture tools, implements, waggons, motor cars, etc. The directors are J. Meldrum, W. Meldrum, R. A. Gentles, W. A. Harper, and C. A. Duclos, all of Montreal.

Crucible Steel Casting Co., Limited, Hamilton, share capital $50,000 purpose to manufacture steel and iron castings. The directors are: G. L. Hushand, Philadelphia, Pa.; and G. E. Husband, E. H. Husband, B. K. Husband and J. Scott, all of Hamilton.

Port Arthur Investment Corporation, Limited, Winnipeg, share capital $50,000, purpose to do general mercantile business. The directors are: J. J. Carrick and George Mooring, of Port Arthur; F. Mariaggi, W. Pearson and H. Pollard, all of Winnipeg.

Collingwood Ship Building Co., Collingwood, share capital $1,000,000, purpose to build vessels, etc. The directors are: T. Long, H. S. Osler, W. B. Raymond, B. L. McCarthy, B. Osler, F. Ford, G. C. Loveys, J. M. Ewan and H. Spence, all of Toronto.

Garson Quarries, Limited, Winnipeg, share capital $50,000, purpose to quarry stone, etc., and do general construction work. The directors are: P. Lyall, Montreal; J. Little, Tyndall, Man.; W. Garson, J. A. M. Aikins, and H. A. Robson, all of Winnipeg.

Peterborough Boiler and Radiator Co., Peterborough, share capital $40,000, purpose to manufacture boilers, radiators and plumbers' supplies. The directors are: E. F. Mason, A. Parker, R. G. Sturgeon, W. S. Davidson, and S. V. Sturgeon, all of Peterborough.

International Oil and Gas Co., Limited, Ingersoll, share capital $200,000, purpose to develop gas and oil wells. The directors are: A. Campbell, R. L. Aldrich, and A. MacLaren, all of Detroit and J. B. MacLaren, of Ingersoll, and W. R. McMullen, of Woodstock.

J. Brown Co., Limited, Neepawa, share capital $100,000, purpose to carry on business as hardware and general merchants. The directors are: J. Brown, W. A. Blenner-Hasset, J. E. Cochran and W. Gibson, all of Neepawa, and R. A. McQuarrie, of Clan William, Man.

Haug Bros. & Nellermoe Co., Limited, Winnipeg, share capital $100,000, purpose to manufacture all kinds of machinery. The directors are: I. J. Haug, N. A. Nellermoe, of Fargo, North Dakota; L. J. Haug, E. E. Sharpe, T. L. Metcalfe, and D. A. Stackpoole, all of Winnipeg.

Toronto Woolen Machinery Co., Ltd., Toronto, share capital $40,000, purpose to manufacture woolen machinery and do a general business as mechanical engineers. The directors are: L. B. Bredannaz, J. Bredannaz, A. Bredannaz, J. M. Ewing and A. G. Ross, all of Toronto.

Wire-Woven-Wood Mfg. Co., Limited, Woodbridge, share capital $40,000, purpose to manufacture wire baskets, boxes, etc. The directors are: J. G. Hallett, F. Bath, and E. Smith, all of Woodbridge, and D. Lamont, P. H. Porter, W. J. Hill and J. Galloway, all of Toronto.

Lakefield Furniture and Mfg. Co., Limited, Toronto, share capital $125,000, purpose to manufacture furniture and do business as machinists and foundrymen. The directors are: J. F. Lillicrap and E. R. Tait, of Lakefield; A. A. Dickson, H. W. Evenden and J. Morrison, all of Toronto.

Hagersville Light & Fuel Co., Limited, Hagersville, share capital $40,000, purpose to develop oil and gas properties and supply power for heating and lighting. The directors are: D. J. Almas, S. W. Howard, Chas. Stringfellow, J. C. Ingles, and W. Swayzie, all of Hagersville.

Fort William is looking forward to big things now that the Grand Trunk Pacific has decided to place its terminal there. Mr. E. A. Morton, a resident of Fort William for the past fifteen years and one who has watched the town grow from an insignificant village of 200 to its present proportions of a city of 8,000 souls, was interviewed in Winnipeg a few days ago. He said: "Inside of five years Fort William is going to have a population of 25,000 and this I believe to be on a conservative basis. Everything is in favor of this proposition. All the C.P.R. supplies, for the main and branch lines, will be handled at the port, and a large number of railway men will be paid their wages there. The development of the Kakabeka water power will employ over a thousand hands, and when completed we shall have about the cheapest supply of power in the Dominion of Canada. Many large manufacturing corporations are recognizing the wonderful facilities which Fort William offers, and the J. I. Case Manufacturing Co., the John Deering Plow Works, and other manufacturing companies, have already started, and many more will be established there in the near future. This will have the effect of making Fort William one of the largest manufacturing centres in Canada."

INDUSTRIAL PROGRESS

Machinery and Manufacturing News would be pleased to receive from any authoritative source industria news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

Fort William has been chosen the lake terminal of the Grand Trunk Pacific, and land values are soaring towards the clouds. Fort William had the advantage over Port Arthur on account of the large amount of lands available, which would allow room for expansion for the next 100 years. It is believed that the Canadian Pacific influenced the G.T.P. in the selection, as with two companies at that point large dredging concessions can be procured from the Government, besides making the Mission River navigable. The site chosen for the terminals is on the Indian reserve property, south of the Kaministiquia. Work will commence at once. There are about 3,000 acres involved, about half being level land, the remainder being taken up by Mount McKay. The limits of Fort William will be extended to take in the territory and a bridge connection made. The G.T.P. will enter Fort William midway between the C.P.R. and C.N.R. The town will pay the railway company $300,000, the final payment of $100,000 when the company has spent $900,000.

A nail factory is being established at Vancouver.

The Colonial Ink Co., Peterboro, will remove to Hamilton.

A mineral water factory is being established at Regina by T. Watt.

Work on the Hamilton, Ancaster, and Brantford Railway has commenced.

A large stove manufacturing concern is looking for a site at Port Arthur.

Victoria, B.C., has declined to bonus the British America Paint Company.

The Grand River Metal Co. have decided not to move their factory from Galt.

The Composite Brick Co. will establish a plant to make pressed brick at Regina.

The Cyclone Fence Co., Toronto, is negotiating with Woodstock for a factory site.

The Deere & Mansur Co., Moline, Ill., may establish an implement factory at Stratford.

Berlin has failed in its effort to induce the Dennis Wire and Iron Works to move from London.

Kelly Bros., stone cutters, Winnipeg, are installing a large electric crane and other machinery.

D. Clark, of Powassan, Ont., is in Winnipeg looking for a suitable site for a big brick plant.

Port Arthur has passed a money by-law bonusing the new blast furnace to be established there.

Brantford is trying to induce the Canadian Wringer Co. to establish a factory in that city.

The proposed electric railway between Hamilton, Galt and Guelph will not be gone on with at present.

The Dailey Rotary Engine Co., Galt, expect to make an important announcement to the trade shortly.

Toronto capitalists are behind a scheme to erect a large power plant at Eugenia Falls in Grey County.

The Canadian Northern Railroad Company has placed an order with British works for 20,000 tons of rails.

The East Kootenay Lumber Co., Cranbrook, B.C., are looking for a location for a branch at Brandon, Man.

The Chibugamoo Mining Company has been organized in Montreal to develop some prospects in Northern Quebec.

The town of Durham will grant a loan to the Durham Furniture Co. to aid in rebuilding their burned factory.

Clark & Demill, of Galt, expect to be established in their new factory at Hespeler about the middle of March.

Berlin is offering inducements to have the Dennis Wire and Iron Works of London to locate in "Busy Berlin."

The Canada Wood Manufacturing Co., of Farnham, Quebec has secured a large order for cane-seated chairs from Cuba.

The American Glue Co., which it was announced had decided to locate at Guelph, are now negotiating with Brantford.

Guelph has granted a free site to the Canada Glue Co., who guarantee to invest $30,000 in buildings and machinery.

The Gall Petroleum and Chemical Co., Mont Tremblant, Quebec, are erecting a plant to manufacture wood alcohol.

A company with $100,000 capital will erect a bridge across the Rainy River from Fort Frances to International Falls, Minn.

The B.C. Electric Railway has nearly completed its new branch in Victoria, the line running out to the celebrated Gorge bridge.

For the first time in many months, the Dominion Iron and Steel Co. have now seven of their open-hearth furnaces in operation.

The Norris Implement Co. have purchased a site in Winnipeg and will erect a factory to manufacture threshermen's supplies.

A bylaw to grant a loan of $15,000 and exemption from taxes to the Sampson Bolt Co., was carried in Gananoque a few days ago.

A Montreal report says that the Dominion Iron and Steel Co. earned $75,000 in January. Further improvement is expected when the rail mill is in operation by June.

The Nova Scotia Steel Co. is supplying considerable steel to the Canada Foundry, and it is said to be of decidedly superior quality.

Toronto and Montreal capitalists have purchased the interests of Mr. David Russell in the Lake of the Woods Milling Co. for $1,800,000.

The Grand Trunk and the Pere Marquette Railways have laid off several hundred men at their shops in St. Thomas and Stratford.

Treherne, Man., has passed the by-law granting a loan of $5,000 to C. Weichman to erect a flour mill on the site of the one recently burned.

Brockville has granted a loan of $30,000 to the Canada Carriage Co., and a site and exemption to the D. H. Burrell Co., of Little Falls, N.Y.

There is a prospect of the Dennis Wire and Iron Co. removing from London to Berlin. The latter place is to vote on the proposition very shortly.

The Economic Construction Company of Toronto are endeavoring to secure a franchise from this city for the erection of a gas plant to cost about $60,000.

The Dominion Coal Co. collieries are beginning to take on labor. No. 2 colliery will, it is said, take on two hundred men during the next week or so.

A Board of Trade has been formed at Picton, with H. B. Bristol as president, D. J. Barker vice-president, P. C. Mackie, secretary-treasurer, and about 45 members.

The Cariboo Consolidated Hydraulic Mining Co. intends installing hydraulic machinery to secure 2,500 miners' inches of water from Spanish Lake, British Columbia.

The Fairbanks-Morse Company may build a factory at Toronto Junction. They manufacture gasoline engines, pumps, etc., and have several large concerns in the States.

New York and Pennsylvania capitalists have decided to build a factory for the new Canadian Shovel and Tool Co., of Hamilton, which has been organized with a capital of $250,000.

The Fredericton, N.B., City Council has refused to grant the petition of E. A. Morgan & Co., carriage manufacturers, who asked for a bonus of $15,000 to enable them to enlarge their business.

The latest concern to choose Montreal as a factory site is the Universal Spring Motor Company, Limited, which is to manufacture the universal spring motor, as well as electric, water and steam motors.

Plans are being prepared for an addition to be built to the Pender Nail Works at St. John, N.B. This will give space for additional machinery, so that the output of the factory can be considerably increased.

The chair factory at Listowel, which was closed down for some time, is to be taken over by the Huebner Co., of Berlin. The negotiations have been completed, but the vote on the by-law has still to be taken.

Brockville capitalists have organized what will be known as the St. Lawrence Engine Co., to manufacture gasoline engines and launches. It has a capital stock of $40,000, and will be in operation next month.

The Board of Trade at St. John, N. B., have unanimously adopted a resolution in favor of the construction of a tunnel between Prince Edward Island and the mainland, and of providing an additional Winter boat in the meantime.

An expert engineer has been employed in Chicago to prepare plans for blast furnaces which are to be established at Port Arthur, and the work of opening up the mines at Atikokan will be proceeded with as soon as a force can be organized.

A large boiler has been installed for the Rat Portage Lumber Co. by the

Manitoba Iron Co. The boiler is eighteen feet long and seven feet in diameter. It contains 104 four-inch flues. The shell plate is nine-sixteenths in thickness.

The Canadian Northern Railway are building five very extensive bridges of steel and masonry at the different crossings of the Saskatchewan River. It is estimated that the total cost of these five fine structures will be close on to $1,500,000.

The directors of the Canada Car Company have decided that the entire big plant to be erected at Montreal shall be constructed of concrete. The main building will be 1,010 feet long and it will be the first concrete plant to be erected in Canada.

The schooner Agawa is being loaded at Sault Ste. Marie with 6,500 tons of steel rails, which will be sent to Port Arthur for the Canadian Pacific at the opening of navigation. It is said there will be a heavy movement of steel rails all the season.

News has been received from Dawson of a rich strike on Big Gold Creek, tributary to Sixty Mile River. A stampede resulted when the news reached Dawson. Two large nuggets, one weighing over 25 ounces, have been found on Hunker Creek.

The customs receipts of the Dominion for the nine months ending with March were $30,916,179, compared with $30,163,283 for the same time last year, an increase of $752,916. The receipts for the month of March were $3,694,161, an increase of $134,909 over March, 1904.

The Canadian General Electric machine shops at Peterboro', for the first time in the history of the company, have started working night and day, owing to the pressure of business. If houses and men could be got the whole works would be put on a 24-hour-a-day basis.

The Canada Iron and Foundry Co., Limited, St. Thomas, Ont., has just moved into its new shops, which comprise a main foundry building 76 x 600 feet, a warehouse 40 x 130 feet, a shipping room 32 x 70 feet, besides a machine shop, power house, and office building.

The Canada Foundry Company, Limited, of Toronto, is under contract for the steel work of the crossing near Battleford, which is the largest, and also for the one at Fort Saskatchewan. The Canadian Bridge Company, Limited, of Walkerville, has the other three crossings.

The Forest City Paving Company of London, has been awarded the contract for the construction of the large foundry for the Ontario Wind Engine and Pump Company at Montreal, and also got the contract for the erection of a 75,000-gallon water tank, which will be 105 feet high.

The war has had a favorable effect upon the metal trade in Japan, and the quantities imported under contract in December and January were as follows: Tin plates, 25,000 boxes, of 112 plates each; sheet iron, 500 tons; thin iron plates, 700 tons; zinc plates, 300 tons; and soft steel, 600 tons.

The Ontario Electrical Development Company is preparing to supply the towns and cities with electrical power from Niagara Falls. It has let the contract for a new half-million dollar power house at Niagara Falls. From there it will send power to Toronto and through Western Ontario.

Representatives of the United States Steel Corporation are taking a trip through Western Ontario with the object of locating a big steel plant in Canada. Amongst the places being considered are Port Colborne, Tillsonburg, Port Burwell, St. Thomas, Rondeau and Walkerville.

One of the big orders sent east from Winnipeg in March was that of the Canadian Northern Railway for a million dollars' worth of new equipment, to be delivered before the end of the year. The purchase includes passenger coaches of all kinds to the number of sixty-two.

A western branch of the Munroe Wire Works of New Glasgow, Nova Scotia, has been opened in Winnipeg with Mr. James Munroe as manager. Their building is 40x100, four storeys, and an annex will be constructed as soon as Spring opens, 70x30, two storeys with a power house and a blacksmith's shop.

It is likely that legislation will be introduced shortly confirming an order-in-Council passed by the late Government, allowing the Electrical Development Co., which in reality is the Toronto & Niagara Power Co., to develop 250,000 horse-power at Niagara Falls, instead of 125,000, as their present agreement calls for.

An arrangement is at present under way for the amalgamation of some of the mining companies in British Columbia, which will provide for the taking in of the C.P.R. smelters, the general manager to be Mr. Aldridge, who has has charge of the Mineralogical Department of the C.P.R. and opened the coal properties near Banff.

Assessment Commissioner Forman, Toronto, has received another application for a factory site on Ashbridge's Marsh, from a large industry employing 100 hands. The firm state that they will be in a position to employ 200 hands in one year after commencing operations in the city. Several other concerns are also after sites in the same district.

Morrisburg has passed two by-laws to raise money to provide for the development of 1,100 horse-power and rapid plant canal and converting the same into electrical power for the purposes of furnishing power to factories, and to grant free power, water and light to J. Wesley Allison, of New York, for establishing a tinplate and sheet industry.

The billet mill of the Dominion Iron and Steel Co. was closed down on March 23 for the purpose of affecting repairs to its foundation, which has been found to be sinking and getting out of plumb on account of heavy frost. This will also necessitate the closing down of the rod mill and will take two or three weeks before repair work is completed.

The St. Mary's Falls Paper Company, with a capital of $100,000, has been organized at S. Ste. Marie, Mich. B. J. Clergue of the Ontario Soo holds a majority of the stock. A mammoth mill, employing a large number of men, will be built early this coming Summer. Only print paper will be manufactured. It will handle all the pulp from the Canadian Soo pulp mill.

The Union Drawn Steel Company, of Beaver Falls, Pa., is closely connected with the new Canadian Drawn Steel Company which is establishing large works at Hamilton. A site has been secured and the main building, which will be constructed of steel and brick, will be 325x60 feet. A full line of polished steel shafting, shapes of all kinds, as well as finished forgings, castings, etc., will be manufactured.

The completed rolling mills of Canada aggregate 18, of which one has a Bessemer steel plant, one a Tropenas steel plant, and five open-hearth steel plants. The annual capacity of the blast furnaces is placed at 830,000 gross tons of pig iron; of the Bessemer and Tropenas steel plants, 200,800 tons; the open-hearth steel plants, 451,000 tons, while the total capacity in finished, rolled and forged products is placed at 839,600 tons.

At present there is some talk of the C.P.R. establishing an iron works on the Pacific coast on a similar basis to those at Sydney, C.B. The need of an iron works on the Pacific coast has long been acknowledged. Fields of iron ore are very prolific on the Island of Vancouver, and especially along the line of the Esquimalt and the Nanaimo Railway, which was recently acquired by the C.P.R.

According to an estimate, the mineral production of Canada for 1904 will exceed that of last year by over $3,500,000. The increase took place in gold, silver, lead and coal. It is estimated that during 1904 there were mined 57,050 ounces of placer gold, 256,135 ounces of lode gold, 3,505,805 ounces of silver, 36,688,580 pounds of copper, 37,000,000 pounds of lead, 1,668,000 tons of coal, and 277,400 tons of coke.

A new saw mill and sulphite plant will be erected at Swanson Bay, B.C. After the manufacture of pulp is well under way, it will be shipped to England. The saw mill will have a capacity of 40,000 feet per day and the sulphite plant will be capable of producing from 35 to 40 tons of sulphite pulp daily. It is the intention of the company—the Canadian Pacific Pulp and Paper Co.—to erect a paper mill in connection with the above plants.

There is a move on to amalgamate the three big rubber companies—the Canadian Rubber Co., the Gutta Percha Rubber Co., of Toronto, and the Granby Rubber Co. Several meetings have taken place between Messrs. Warren, Miner and Sir Montagu Allan and others, but the deal is still in abeyance, and so far nothing has come to a head. The people who recently undertook the big cotton company amalgamation are interested in the scheme.

J. M. Campbell, of Kingston, is engineer of the new electric railway at Edmonton, Alberta. He has awarded most of the tenders, and the work will be begun in a few weeks. It will extend from three to five miles, and include a number of neighboring villages. The cost for rails and ballast will be $15,000 a mile. For machinery for the power house alone without counting the building. $16,000 will be required. The road will be running by Sept. 1.

Maritime Boards of Trade are urging the Dominion Government to grant a bonus on a tonnage basis to promote the steel shipbuilding industry in Canada. Five dollars per ton bonus is asked for. A company has been organized in Halifax to establish a steel shipyard, and if the Dominion Government grant a liberal bonus the industry promises to be established at an early date. The

City of Halifax and the Nova Scotia Government are each prepared to grant $100,000 subsidy.

The Cyclone Wire Fence Co., of Toronto, have decided to locate in Woodstock. They have been given a free site by the city, and will at once proceed to erect a large factory. The Ann Arbor Machine Co. have secured a site from the C.P.R., and they, too, will at once put up a factory. These, with the factory to be built by the Eureka Planter Co., of Windsor, will make three factory buildings to be erected in Woodstock this Summer.

One of the enterprises that has contributed to the upbuilding of Winnipeg is the Rat Portage Lumber Co.'s establishment in Norwood, St. Boniface. The erection of a large mill last year and the employment of a large number of men has largely increased the business of the suburb. Last week a big sash and door factory, the largest of its kind in the province, and one of the largest in the Dominion, was opened there by the same company.

The Empire Elevator Co. will construct another large elevator of approximately 1,750,000 bushels' capacity. The big plant will be constructed of steel and tile, and will be located near the site of the elevator company's present building at Fort William. Since the passing of the blast-furnace by-law in Port Arthur recommending the construction between the two towns of a $1,000,000 blast furnace, property in the locality of the proposed furnace has risen to tremendous values.

In Montreal, lead corroding works have been established at a cost of some $200,000, and will shortly be in operation. The raw material used is pig lead, dutiable at 15 per cent. Corroded lead itself is subject to a duty of 5 per cent. In order to obtain an equalization or adjustment of the duties, Mr. Cornish, the manager of the works, accompanied by Mr. Wm. Galliher, M.P., and Mr. Retallick, of British Columbia, waited upon the Canadian Minister of Finance this week. Consideration was promised.

Twenty tons of gold have been produced by the Klondike proper, the district within a radius of fifty miles of Dawson, since January 1st of this year. In other words, the output of the Klondike since the first of this year is $9,200,000. The royalty collected on the gold by the Canadian Government for the year is $230,200. The banner year in the camp was in 1900, when the output was placed at $20,000,000. Since that the cream of the richest claims has been taken and low-grade areas are being worked.

A steel railway dry dock is now assured for North Sydney, Cape Breton, of sufficient capacity to accommodate steamers and vessels of five thousand tons. The necessary capital of $250,000 has been subscribed, most of which is held by Joseph Leiter, the famous wheat king, and other Chicago people. The Dominion Government will give a subsidy of $6,000 a year, and the concern will have a local bonus and Provincial subsidy. Captain J. A. Farquhar of Halifax is the principal man behind the promotion of the enterprise.

The Grand Trunk Pacific have acquired from the original owners about 17,000 acres of land, now incorporating as the Bulkley and Telkma Valley Coal Co., in British Columbia. The capitalization is one million. The Grand Trunk have also acquired the charter of the Pacific Northern and Omineca Railway Co., which was chartered by the Dominion and Provincial Governments in 1901 to construct a railway from Kitimaat to Hazelton, with branches to the Bulkley and Telkma coal fields. The company have a subsidy of $5,000 a mile.

The coal miners at Springhill are considering the proposal of the management of the Cumberland Coal and Railway Co. to cut wages of miners, about 12 per cent., equal to the last increase in wages. The cut would affect 500 employes out of the very large number of men in the employ of the company, and they, of course, are the best paid men in the mine. The company say they made no money last year; the men reply that nearly $100,000 of new permanent improvements on the surface works and railway were paid for out of revenue. Trouble may develop out of the dispute.

Development work has commenced at Fort Frances by the Koochiching Power Co. The first work to be done will be placing the big coffer dams, which will require four million feet of timber, after which the dam will be constructed; the latter alone will require 50,000 barrels of cement; this with the mills and works will take another 50,000 barrels. The total expenditure will run over $3,000,000, employing 300 men. The machinery consisting of steam hoists, engines, derricks and cranes, are arriving daily, the first car being now unloaded. This will make Fort Frances a busy place the next two years.

The Ontario Wind Engine and Pump Co. are opening a branch at Montreal, having leased a large, commodious warehouse and office, where the requirements of their Quebec patrons will be more thoroughly attended to. They were successful tenderers for a 75,000-gallon steel water tank on steel tower 105 ft. high, to be erected for the new factory of the Canada Car Co., Montreal, and which has to be completed by June 3rd. With their Montreal and Winnipeg branches, in addition to the Toronto head office, they should be in a position to take care of all the trade placed in their hands.

In The Mining Magazine, of New York, appears an editorial on the condition of the coal industry, evidently prepared by an expert in possession of reliable data. The following figures are of universal interest and permanent value: Estimates of the production of coal during the past year indicate an output nearly as great as in 1903, when the production of bituminous coal was 285,000,000 tons and of anthracite 59,000,000 tons, a total of 344,000,000. In 1904, the output of anthracite was 57,492,522 tons and the estimated production of bituminous coal 281,000,000 tons, a total of 338,000,000 tons.

The recent decision of the Canadian Government to grant a bounty of $6 per ton to encourage steel shipbuilding should be the means of building up a large industry in Canada. The City of Halifax and other municipal authorities some time ago offered a joint cash subsidy of $300,000 to any company that would establish a steel shipbuilding plant at Halifax. The Government tonnage bounty is regarded as a further step in the same direction. The bounty is applicable to the whole of Canada and its adoption was supported by delegates from Canadian rate ports, British Columbia and Nova Scotia.

A Philadelphia despatch says that foreclosure upon the property of the Michigan Lake Superior Power Co., and a reorganization of the company, are recommended by a committee acting for the first mortgage bondholders of that corporation. This is the result of a demand for cash to put the company's great power plant and canal at Sault Ste. Marie in proper condition, and of an announced anticipated default in $175,000 interest on the bonds due May 1. Severe reflections are cast upon the Lake Superior and the old Consolidated Lake Superior Companies for certain methods pertaining to the controlled company.

The Munro Wire Works, of New Glasgow, N.S., have placed an order for the necessary steam plant for their Winnipeg branch factory with the Robb Engineering Co., of Amherst. The Ruggles-Coles Engineering Co., of New York, have ordered from the Robb Co. a 350-horsepower Corliss engine and two 175-horsepower boilers for the cement works being built at Sydney, C.B. The Robb Co. is also building two 125-horse-power boilers for the Lethbridge Electric Co., of Lethbridge, Alberta. The Restigouche Lumber Co., recently organized to operate a large wood-working factory at Dalhousie, N. B., have ordered a steam plant from this progressive Amherst company.

In the mining of iron ore, cheap transportation is almost indispensable. In this respect the known deposits of iron on the coast of British Columbia are certainly advantageously situated, for the majority of them are within easy reach, by short and inexpensive tramways, of the navigable waters of one or other of the many inlets along the coast line. On the waters between Vancouver Island and the Mainland, transportation by means of barges is quite practicable, whether for ores, coke or fluxes. For most of the ores of the west coast of Vancouver Island where more open and rougher seas are met with, seaworthy sailing vessels or steamers are required.

The Imperial Steel and Wire Co.'s plant at Collingwood is working night and day. The company has enough business booked to keep the plant busy till June. Their machines are of the most modern type, and run through the dies about 450 feet of wire every minute of the working day. The company intend to make a specialty of cement-coated wire nails for box purposes. A secret method of coating will be used, whereby the heating of the nail will in no way destroy its strength. The present output of the nail mill is about twenty-five tons a day. A complete keg plant has been put in which will meet all the company's needs in that line.

The bonus of $250,000 offered by the City of Sydney, Cape Breton, two years ago to any company which will start a shipbuilding industry in the city within three years, is being sought by a company recently formed. This company not only intends to erect a shipbuilding plant capable of turning out one 15,000-ton steamer every year, but will also build a floating dry dock which will hold an 8,000-ton vessel, and keep a wrecking steamer stationed at the port. The company guarantees to spend $1,000,000 before the bonus is claimed, but no pro-

vision is made for its property reverting to the city should the plant at any time be closed down through mismanagement or otherwise.

The annual statement of the Canadian General Electric Company, states that profits for the year were $582,519.60, or $70,298.81 in excess of profits in the previous year. The reserve fund is now $1,239,770.00 plus $100,000.00 at credit of Contingent Account, and $81,913.42 balance at credit of profit and loss, making the total surplus $1,421,683.42.

Reports from the woolen centres state that the export trade to Canada just now is extremely sound. Large orders are daily being booked. An order for 7,000 tons of cast iron pipes for Canada has been placed with Glasgow and English firms. Other Canadian contracts are expected at Glasgow. Canadian orders for Sheffield steel are stated as satisfactory.

Large orders for railway material and structural iron have been placed in Liege by firms in Argentina, according to a report by James C. McNally, United States Consul at Liege, Belgium. They are divided among four of the principal mills, and are being expedited as rapidly as possible. These, as well as other outside orders, have encouraged the manufacturers of steel and iron material to improve their works, and to replace old plants with modern, up-to-date machinery of extended capacity, and capable of meeting demands for quick delivery. Two important steel works of Liege are at present working on an order of 6,800 tons of street rails for tramcars for English firms.

Mr. Gibson, the Director of Mines, Toronto, has an immense nugget of silver taken from the Trethewy mine, near Cobalt Station, on the Temiskaming Railway. It is a striking example of the richness of the mineral deposits in that district. Twenty-five inches long, twelve inches wide and two inches thick, it is practically all silver. It weighs 80 pounds, and Mr. Gibson places its value at about $350. Five openings are now being worked in that locality, and since their discovery, a year and a half ago, about a half-million dollars' worth of ore has been shipped from the district. It not only bears a large proportion of silver, but also cobalt. Recently other veins of silver had been discovered, which have proved very rich.

President Corey, of the United States Steel Corporation, has issued the company's annual report for the twelve months ended December 31 last, showing a decrease of $92,167,000 in gross earnings compared with the corresponding period of 1903. In his report, Mr. Corey says: "The depression in the iron and steel trade, which, in common with all other lines of business, took place during the Summer of 1903, continued until the late Fall of 1904. In the latter part of the year 1904 there was a marked increase in the volume of business received, and this revival has continued. The tonnage of unfilled orders on the books on December 31, 1904, was 4,696,203 tons of all kinds of manufactured products, in comparison with 1,325,123 tons at the close of 1903."

Close to 25,000 tons of steel billets, rails, beams, bars, hoops, plates, wire, wire nails and iron pipe made by the United States Steel Corporation, were exported in January through New York and other eastern seaboard points, while heavy shipments were also made to the Far East by way of the Pacific. This brought the total of January exports to fully 50,000 tons. The billet consignments went to England principally. Rails went largely to Japan and Korea, while wire went to South America, Australia and the Far East. Japan was also a large buyer of wire nails and iron pipe. The January imports of iron ore, manganese ore, chrome ore, iron pyrites, pig iron and miscellaneous material, bought largely for Pittsburg account, exceeded 75,000 tons.

The Granby Consolidated Mining, Smelting and Power Co., Limited, of Grand Forks, B.C., which is now operating six furnaces, with a daily capacity of 2,000 tons, for the treatment of the ore from its mines at Phoenix, B.C., has determined upon an increase of its product to about 3,000 tons per day, to take care of the enlarged output coming from the mines. Accordingly, an order has been placed for two new furnaces, which will measure 48 x 208 inches at the tuyere line. It has also been decided to increase the capacity of the converters by the installation of another blowing engine of the latest design. All of the apparatus will be furnished by the Allis-Chalmers Company, which originally took the contract for the entire equipment of the Granby Company's plant.

The C.P.R. is doing active development work in British Columbia. Mr. Marpole, western superintendent of C.P.R., says that the C.P.R. not only intend to build north to Comox, on Vancouver Island, but west to Barkley Sound, from which point the west coast of Vancouver Island will be handled. The contract for the new C.P.R. hotel at Victoria, which will cost half a million dollars, has been awarded. The C.P.R. have expended three million dollars on Vancouver Island and Victoria in the last few months. It is also the intention to replace the present car ferry from Ladysmith, via Vancouver Island and Vancouver, with a modern ferry to accommodate two dozen cars and provide an adequate service for unbroken carload shipments to Victoria.

D. D. Lewis, manager of the Algoma Steel Company's works at the Soo, states that during the Winter they have handled the finished product of their mill very economically, such rails as they have had to stock for Spring shipment being carefully piled by means of electric winches, thus reducing cost to a minimum. In this way, when Spring opens, these rails can be loaded on cars by electricity at the very minimum cost. They are now engaged in loading boats at their docks with rails for shipment to Port Arthur on the opening of navigation. The rail mill is completed and in operation, with the exception of the metal mixer, which will enable the company to use the product of their furnaces direct to the converters. The mixer is now about 90 per cent. completed.

The Grand Trunk Pacific have acquired from the original owners about 17,000 acres of land, now incorporating as the Bulkley and Telkma Valley Coal Co., the directors being Messrs. C. M. Hays, F. W. Morse, A. C. Vernon, F. S. Barnard, E. T. Russell, E. V. Bodwell and H. H. Hays. The capitalization is $1,000,000. The Grand Trunk Pacific have also acquired the charter of the Pacific Northern and Tomineca Railway Co., which was chartered by the Dominion and Provincial Governments in 1901 to construct a railway from Kitimaat to Hazelton with branches to the Bulkley and Telkma coal fields. The company has a subsidy of $5,000 a mile, and it is presumed that the Grand Trunk Pacific will build it as a branch line. They have two years yet in which to complete construction.

The total production of all kinds of pig iron in Germany during 1904 slightly exceeded 10,000,000 tons. It is estimated that it will be in round numbers 10,075,000 tons against 10,085,634 tons in 1903. For the eleven months ending with November, the total production was 9,232,747 tons. The November production was 835,255 tons as against 868,523 tons in October, 1904. The German blast furnaces closed the year with production on a decreasing basis, whereas the United States closed the year with nearly all available furnace capacity in blast, and this not large enough to supply the demand. The present strike of the coal miners in Germany will ultimately cut down pig iron production and enhance the cost as the value of coal and coke rises with the prolongation of the labor troubles.

The annual report of the Nova Scotia Steel and Coal Company for 1904 shows a profit of $501,337.24, which, with the balance of $685,642.62 from 1903, makes a total at credit of profit and loss on 31st December, 1904, of $1,186,979.86. Of this, $50,000 has been added to reserve, $10,000 paid in directors' remunerations, three quarterly dividends on preferred stock, and one half-yearly on the common have been provided for, as well as sinking fund and bond interest charges, leaving balance at the credit of profit and loss, January 1, 1905, of $695,749.86, compared with $685,642.62, January 1, 1904. The report says: "The volume of general business transacted by the company during the past year did not differ greatly from that of 1903. The quantity of coal mined was considerably increased, and the present year will doubtless show a still further increase. The tonnage of iron sold was reduced during the year by 156,000 tons. Owing to the severe depression in the iron and steel trade in Europe and America during the year, the price obtained was much less than during 1903, the difference in the amount of net profit being in round figures $180,000. Since the turn of the year prices have materially advanced. We have orders booked for a larger tonnage of steel and pig iron than ever before, at better prices than prevailed during last year. The present indications are that a larger margin of profit will be realized in this branch of the business during the coming year."

The largest coal-carrying fleet that has yet sailed out of Sydney harbor will be employed by the Dominion Coal Co. during the coming season in the St. Lawrence River trade. The fleet will comprise the following chartered boats: Catalone, Mystic, Dominion, Tordenskjold, Tanored, Britannic, Harrod, Ovidia, Symra and the James Ross, besides the company's own steamers Coban, Louisburg, Cape Breton, Bonavista and Cacouna. They will also have the steamer Turpin, chartered for the coast trade alone. The James Ross, called after the president of the company, is a new steamer now in course of construc-

tion at Middlesboro, England. She is being built specially for coal trade, and will have a capacity of 7,000 tons. The steamer will be launched in a few weeks, and will reach Canada in time for the season's shipping.

Two new furnaces have been shipped from Chicago for the Granby smelter.

The Ontario Government is to revise the mining laws of the province. The mining district of Nipissing is to be established.

The Minister of Railways has awarded a contract to the "Soo" rail mill for the supply of 10,000 tons of steel rails for the Intercolonial Railway.

The mining regulations of the Yukon are to be codified and embodied in a Dominion statute this session. The royalty on copper and gold quartz mining will also be remitted for ten years.

The Chihougamoo Mining Co. have sent men to commence operations on the development work of their asbestos, copper, gold and magnetic iron property at Lake Chibougamoo, on the height of land in Quebec.

The bore hole at St. Rose, Nova Scotia, has been put down 647 ft. At 575 ft. 8 ft. of bright coal was passed through. At a depth of about 200 ft. 8 ft. 4 in. of dirty coal was passed, and at 92 ft., 4 ft. 1 in. of bright coal was found.

The Dominion Coal Co. expect to ship about 2,100,000 tons of coal this season, or about three or four hundred thousand more than last year. Of this, a small amount has been contracted for to be delivered in Toronto and other Ontario points.

The Montreal Steel Co. is about to enlarge its plant. It has been found that another department will have to be added to the works, to manufacture a certain kind of steel employed in variour Canadian industries, amongst others by the Canada Car Co., etc.

The Dominion Coal Co. are making arrangements for the erection of a discharging plant at Halifax. This is evidence that the company anticipates extending its business at this point as a tower costs all the way from twenty to forty thousand dollars. The company have secured a wharf property adjoining the Tram Co.'s power house.

The Algoma steel rail mill of the Lake Superior Corporation has made a new high record of 93 heats in 12 hours, or a total of 922 rails, or 362 tons, in a half day. This would give a total of 724 tons in a day of twenty-four hours, while it was intended that the capacity of the mill should be 500 tons a day. The mill is trying to fill the 25,000-ton contract for the Canadian Pacific Railway in record time.

A special application of the steam hot-blast system of drying has recently been made by the B. F. Sturtevant Co., of Boston, in the Beaver Falls plant of the Armstrong Cork Co. The installation consists of a regular engine-driven fan and tempering coils, with a system of galvanized iron distribution ducts. Through these ducts the heated air is positively forced to the tempering floor, where it accomplishes the delicate process of drying the thin sheet cork insulation without harmful effect.

The best test of the efficiency of German iron works and iron workers is obtained by examining the average output of iron and steel per worker employed, where reliable information on that point is available. The average annual output of pig iron per workman increased from 243 tons per workman in 1901 to 280 tons in 1903, a difference of 37 tons per year. In the case of steel workers, the average annual output rose within the same period from 50 tons to 63 tons, an advance of 12 tons annually, or 24 per cent.

A party of capitalists recently visited Glenora, Ont., with Mr. H. C. Kennedy of Wiarton, who has secured an option on the famous lake on the mountain at this point. It is proposed to make an electrical development of considerable magnitude, power being transmitted to towns within a radius of fifteen or twenty miles, and electric railways installed to interconnect the various towns and villages in the neighborhood. The available head is approximately 180 feet, and a test to ascertain the amount of water which the lake will furnish will be made in the near future. Mr. K. L. Aitken of Toronto, is consulting engineer.

The recent purchase of 20,000 tons of steel rails from Bolckow, Vaughan & Co., of Middlesboro, England, by Mackenzie & Mann was made on the arrangement that deliveries would be in amounts of 3,500 tons per month in May, June, July and August, the balance in September. Mr. Mann stated that the James Bay railway would be completed as far as Parry Sound and that trains would be running by the 1st of September, and by the end of the year it would be completed to Sudbury. The reason that the rails were being imported was that the Canadian mills were unable to supply them on such short deliveries their capacity being ordered ahead for some time.

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Another Company Extending.

Another American company that is extending its grasp on the Canadian trade, in anticipation of the coming building operations, is the Philip Carey M'f'g Co., of Lockland, Ohio. This company manufacture Carey's magnesia flexible cement roofing, Carey's asbestos sectional steam pipe and boiler coverings, asbestos and asphalt materials, and Carey's eighty-five per cent. steam pipe and boiler coverings. This company was established in the year 1873, and since the origination, besides owning one of the largest manufacturing plants in the United States, have steadily increased the number of their branch offices, until to-day their branches number thirty-five. Two of this number are Canadian — one on Front street east, Toronto, under the management of Mr. Cole, which has been established for some few years, and the other is the one recently opened at No. 22 Victoria square, Montreal.

* * *

A New Machine Shop.

The Robb Engineering Co., Limited, of Amherst, N.S., have recently completed a new machine shop to take charge of their increasing output of Robb-Armstrong engines. The building is 250 ft. long by 100 ft. wide, with heavy stone foundations, brick walls and roof of mill construction, consisting of 3-in. plank carried by massive southern pine rafters. There is abundance of light obtained by the use of 6,114 lights of 12x16-in. glass, equal to 8,152 sq. ft. Half of the building which forms the erecting floor for assembling heavy machinery will be served by an electric crane with a capacity of 25 tons, and an auxiliary hoist of 5 tons. The machinery of the entire works is to be driven by electricity supplied from a central power-unit, consisting of a Robb-Armstrong Corliss engine and Canadian General Electric dynamo, and is distributed by wiring to a number of Canadian Westinghouse and Bullock electric motors through the shops. Some of the larger tools have individual motors attached, and the medium and smaller ones will be grouped so that one motor will operate half a dozen or more machines. Economy has been observed in the interior arrangements. The new machine shop is so arranged that the castings come directly from the foundry into one side of the erecting floor, and are distributed by the electric crane to any part of the shop where they are to be machined or fitted, and finally returned to the erecting floor to be assembled and tested. A branch railway siding passes through one end of the shop for convenience in loading. Machinery to be loaded for shipment can be simply picked up by the crane from the testing department or any part of the shop and dropped on the cars.

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Further Electrical Developments.

The Niagara-Welland Power Co. of St. Catharines, Ont., have recently placed several survey parties in the field for the purpose of making the final surveys and locations for the transmission lines which this company propose to construct from their power-house site through to Brantford, via Hamilton, thence to Ingersoll, Woodstock, London and St. Thomas, with branch line starting from Brantford running in a northerly direction through Galt to Preston, Berlin and Stratford. Another branch will originate at Preston and run to Guelph via Hespeler. The survey work is in charge of the resident engineer, Mr. John MacCunn, C.E., and will follow the original routes laid down by the consulting electrical engineer of the company, Mr. Roderick J. Parke. Mr. Parke made a preliminary inspection of the district last Fall, he having gone over the entire route, some 300 miles, in an automobile. The company have also practically completed the final surveys, and are now making preparations for undertaking the preliminary work in connection with the construction of the power canal between the Welland River and the proposed site of the power-house near St. Catharines. It is contemplated to develop 100,000 h.p. at the outset, and to install hydraulic and electrical machinery of 50,000 h.p. capacity at the outset. The ultimate capacity of the power plant, however, will be 200,000 h. p., as the company have ample facilities for the development of this amount of energy. The power house will be located at a point at the foot of a cliff known as "The Bluff," located about 2 miles due east from Merritton, and within a mile of the Welland Canal. This development will be practically along the same lines as that of the Hamilton Cataract, Power, Light & Traction Co.'s works at De Cew Falls. The initial expenditure for power plant and transmission lines will be in the neighborhood of six million dollars.

A MODERN GALVANIZING PLANT AND ITS PROCESS.

IT is both instructive and interesting to note the rapidity with which many of our industries have progressed, and the development which has, one might say, been "brought" upon them, more by the exigencies of the situation than by any deliberately set purpose in the industry itself. An excellent illustration of this is presented in the Ontario Wind Engine & Pump Co., Limited, a concern which set up some ten years ago with the modest ambition of establishing a "pump" business, but soon discovered that if it were to meet the situation as it presented itself, it must be prepared to materially increase its objects. What was demanded was not merely pumps, but an inexpensive power to operate those pumps, hence, the only thing to be done was to push out and establish a "windmill" business to meet the demand. Quickly following in the van came the adaptation of the "air-motor" as a power medium for the working of a multiplicity of smaller machinery, and from that developed in rapid succession the addition to their manufacturing of grinders, wood-cutting machines, flag staffs, drinking troughs, water-basin systems, supply tanks, water towers and reservoirs for the equipment of municipalities, each addition being the natural outcome of demand. This gives a fair idea of the general development which inevitably follows when business is exploited on good business lines. There is, however, another side to the situation, and one of equal importance, viz., that of coping with the many intricacies of manufacture. For instance, in the business under consideration many details had to be faced, such as the equipping of a foundry, establishing of machine, wood-working, blacksmith and paint shops, and ultimately, in order to bring the business to greater efficiency, the fitting out of a complete galvanizing plant. This latter has been an enterprise which has extended beyond anticipation, and in result has established itself as a business doing a large general wholesale trade. It is now some years since the proposition was first considered, and at that time a galvanizing shop was erected sufficient to meet the demands of that date. Some three years later, however, it was found necessary to substantially extend the capacity by the erection of a larger building, and a galvanizing kettle was built of the largest pattern then in use in Canada.

Galvanizing Plant.

Galvanizing has, however, continued to make such progress that the company have had to build another new and much larger factory, which covers a space of some 110 feet by 60 feet, and is equipped with a plant to cope with any and every description of galvanizing. The new kettle which has been built measures some 25 feet by 6 feet, and has a capacity of 50,000 lbs. of spelter. There are also some eight pickling and acid tanks, some measuring as much as 22 feet by 4 feet. A special hot-air kiln has been erected to better facilitate the working. The galvanizing process is one little understood, and perhaps on that account small interest has been taken in it in Canada. We give herewith a cut of the new galvanizing shop of the Ontario Wind Engine and Pump Co., to give an idea of such a factory. The article to be treated is first placed in one of the immense pickle tanks, and then subjected to an acid bath to free it from all foreign matter, after which it is washed in a liquor bath and conveyed to the drying kiln previous to its receiving the final galvanizing. Each of these processes has to be carefully watched in order to ensure perfect results. It is then passed into the boiling cauldron of molten spelter and left till the required quantity of metal adheres. On being removed it is speedily cooled in cold water, which leaves the article with a beautiful bright appearance similar to silver-plate. This process, as many of our readers know, preserves metal from rust and corrosion, and especially is the treatment advantageous to wrought-iron pipe, which lasts a life-time after being galvanized.

The company have the services of a foreman of large experience both in England and the States, and the process followed was decided upon after visiting several of the more important galvanizing centres of the United States.

ELECTRICITY IN INDUSTRIAL APPLICATION.

THE number of motors in use ten years ago in manufacturing plants was very limited, but as the size of factories increased, spreading over greater areas, the older forms of power transmission and machine drive became more impracticable, and electricity rapidly moved to the front. This increase in the applications of electric motors has grown to such an extent that it would be difficult to name a single industry into which this form of drive has not entered.

Orders for hundreds of these motors, both alternating and direct current, are received every week by the Westinghouse Electric & M'f'g Co., a couple of which will serve to show the extent of this business. The Alliance Machine Co. and the Morgan Engineering Co., both of Alliance, Ohio, last week placed orders for a total of 120 crane motors, with an aggregate of 2,000 horse-power. They vary in size from 1 to 100 horse-power. The Pennsylvania Railroad Co. on the same day contracted for 20 induction motors, to be added to their present motor equipment, and the Bethlehem Steel Co. entered an order for direct-current motors to be used in their mills. Numerous smaller orders would make up a list of applications which would cover the whole field of motor-driven machines.

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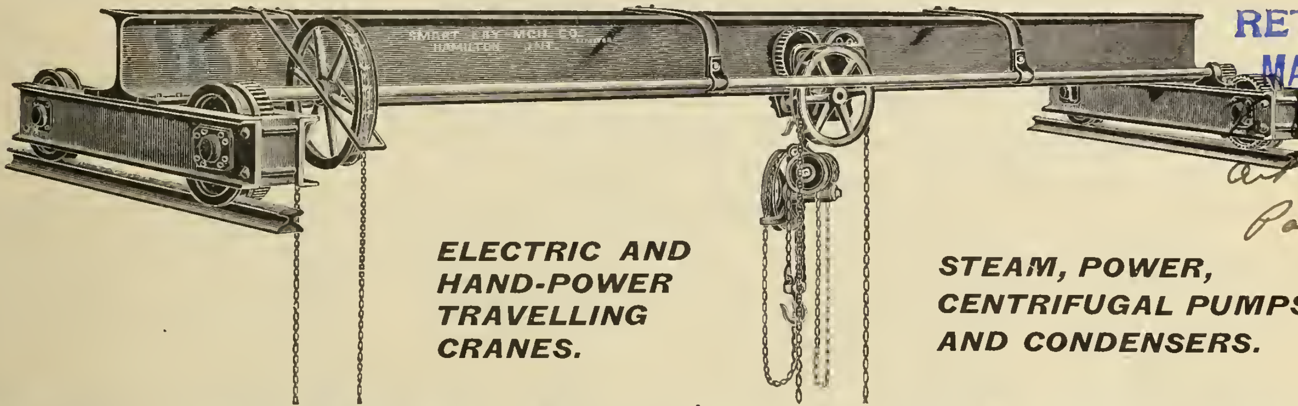

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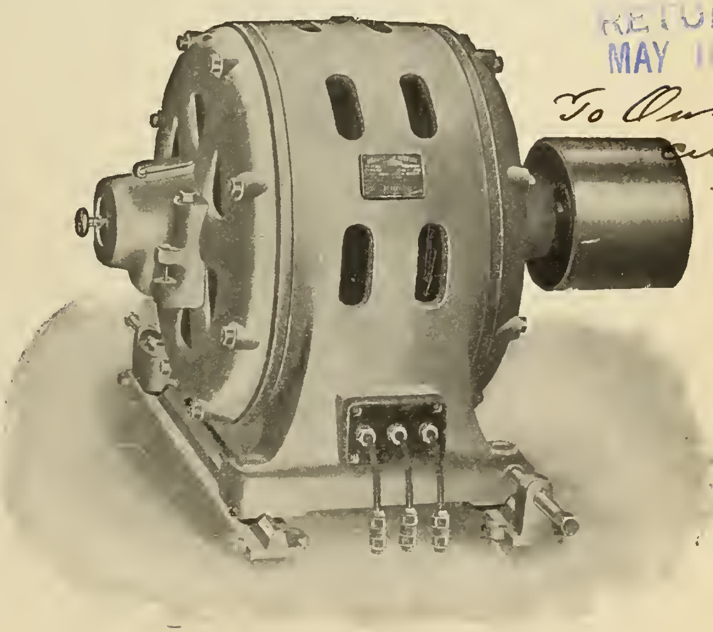

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Cash remittance to cover cost **must** accompany all advertisements. **In no case** can this rule be overlooked. Advertisements received without remittance cannot be acknowledged.
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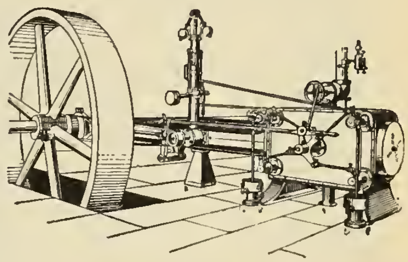

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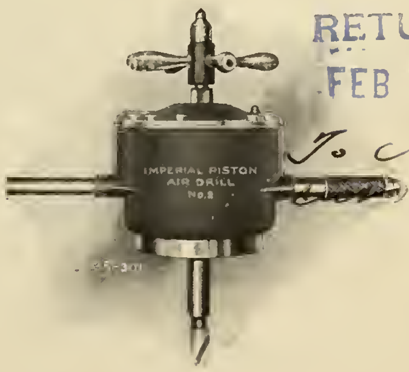

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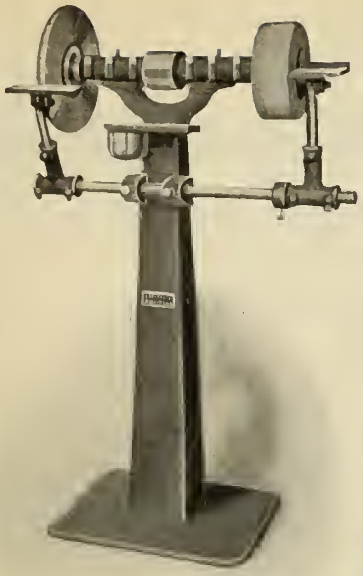

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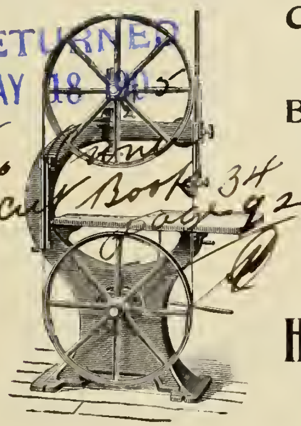

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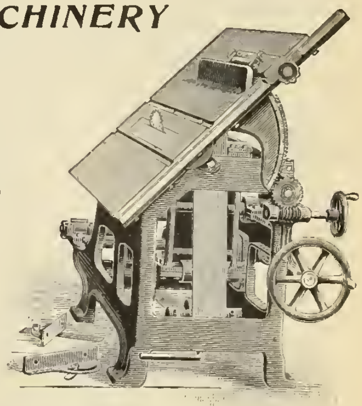

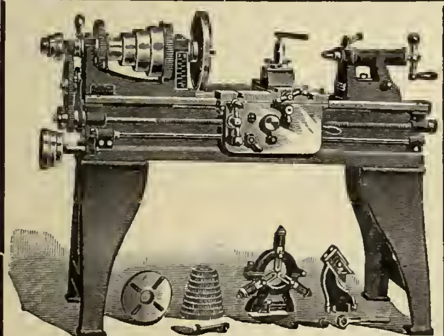

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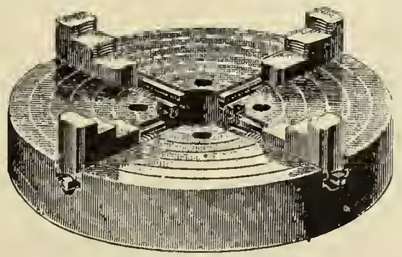

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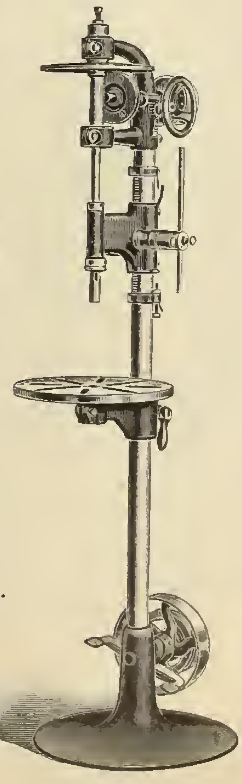

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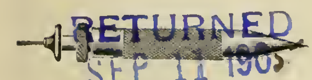

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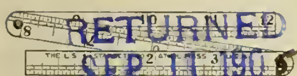

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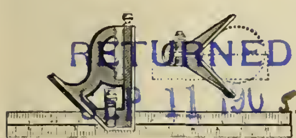

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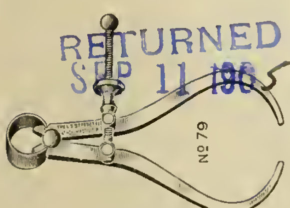

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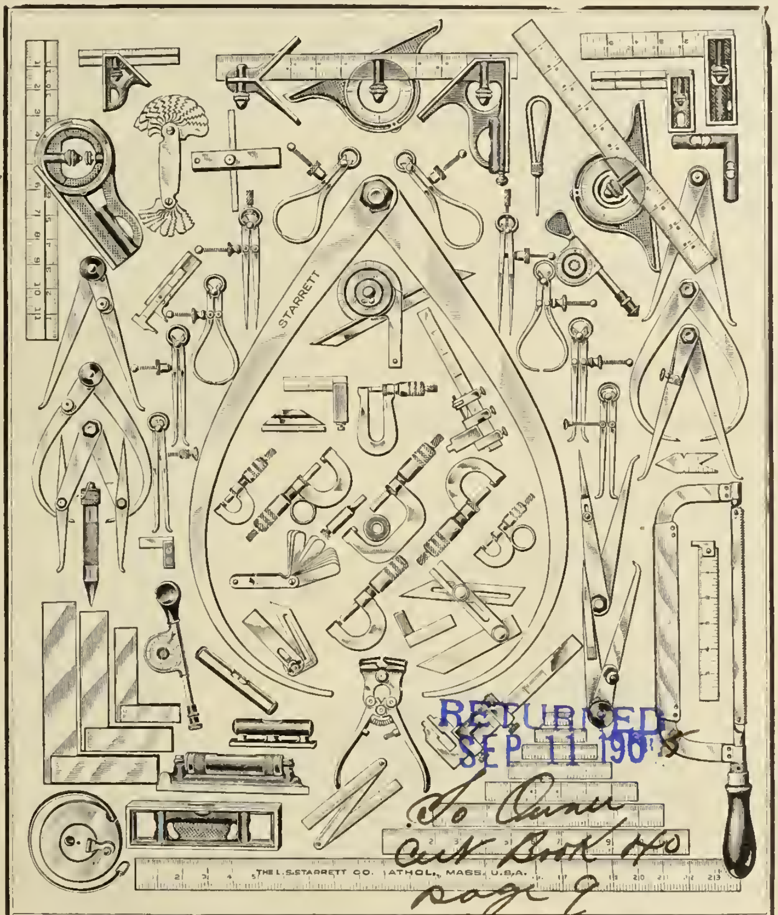

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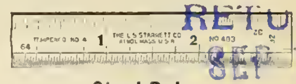
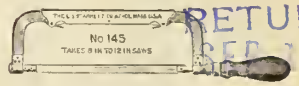


Steel Rules



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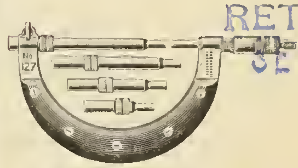

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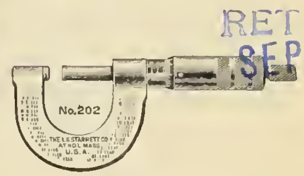
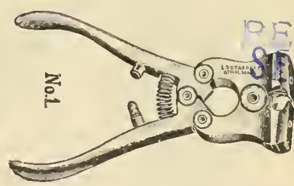


Micrometers



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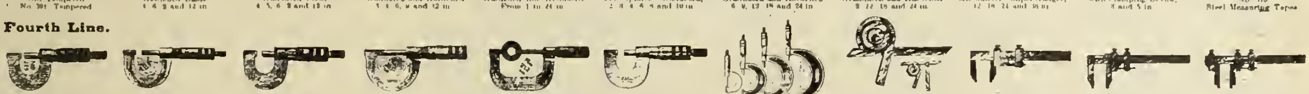

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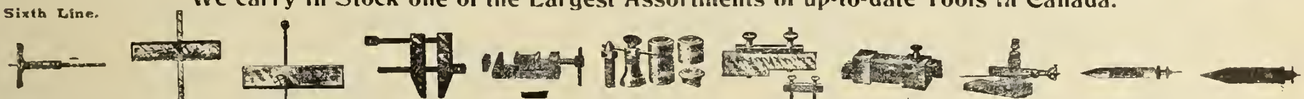

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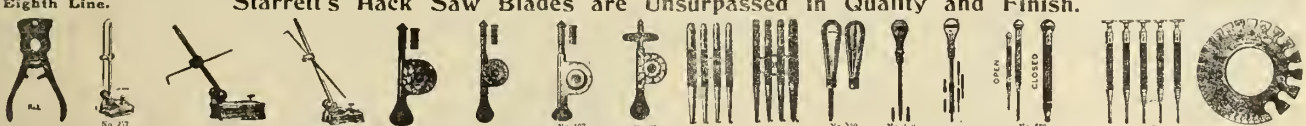

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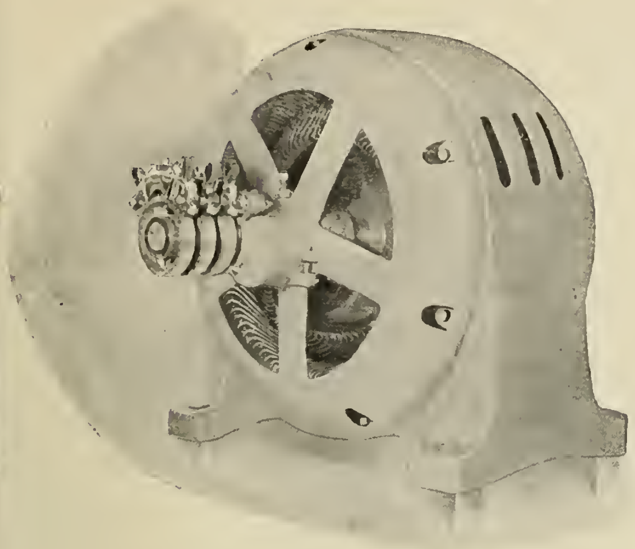

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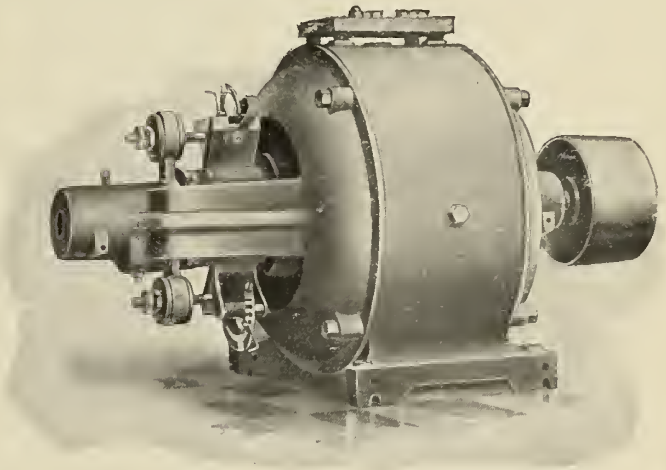

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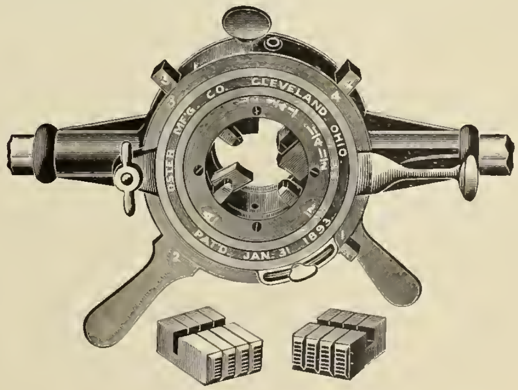

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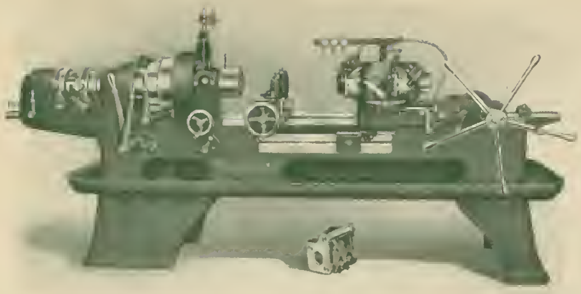

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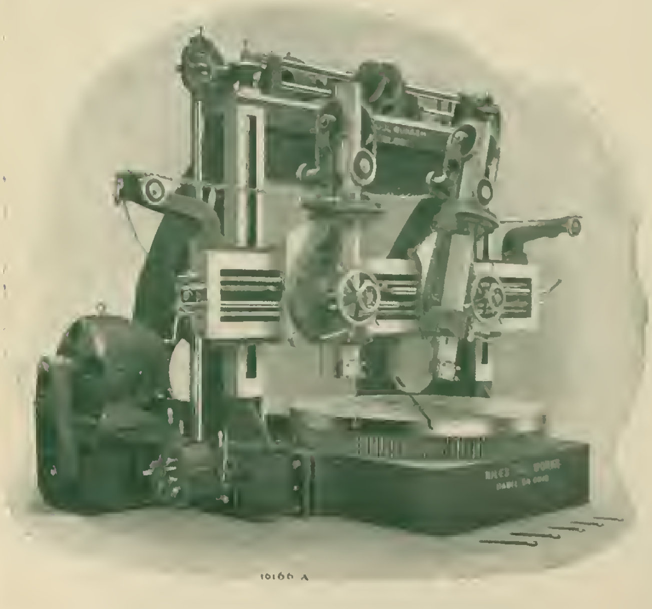

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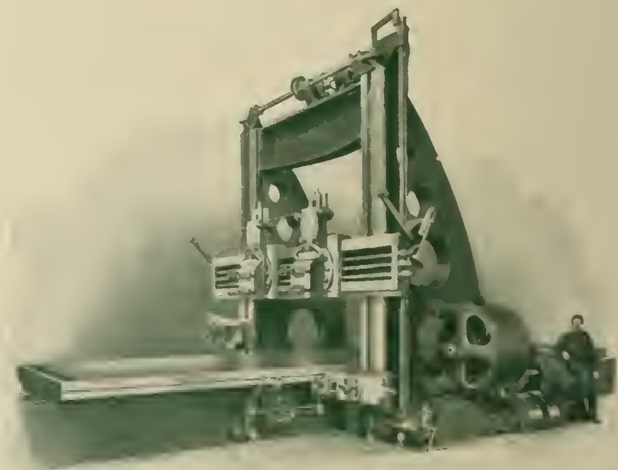

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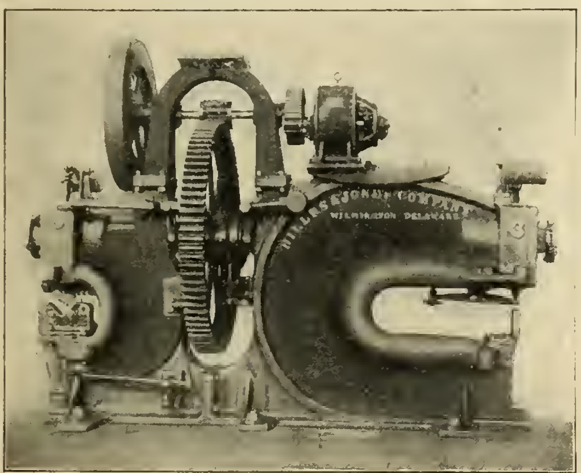

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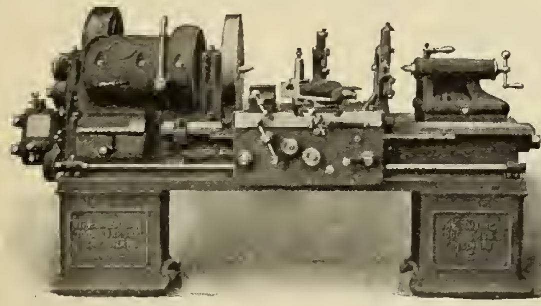

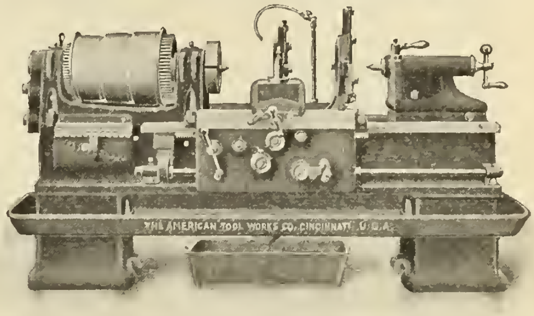

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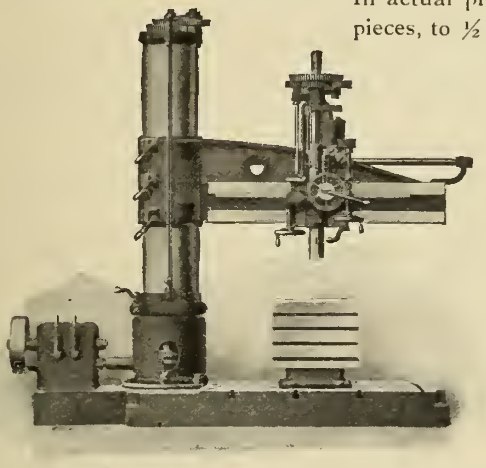

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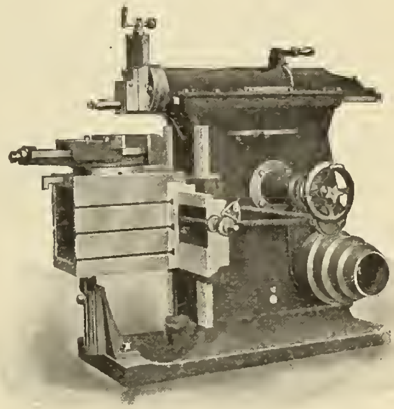

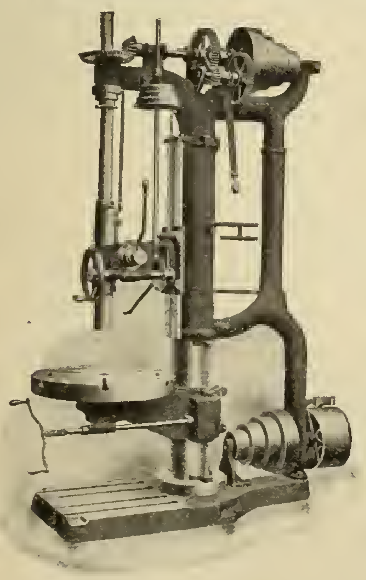

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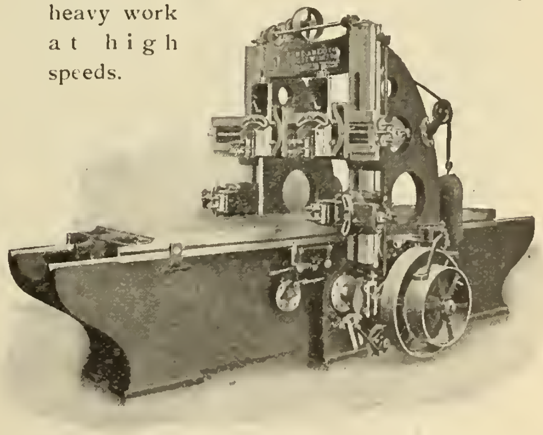

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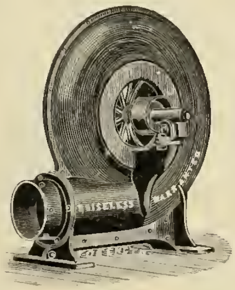

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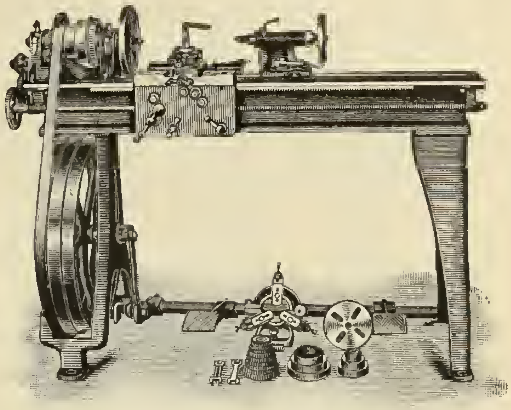

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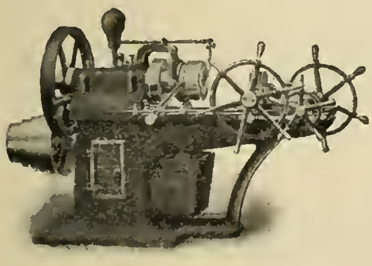

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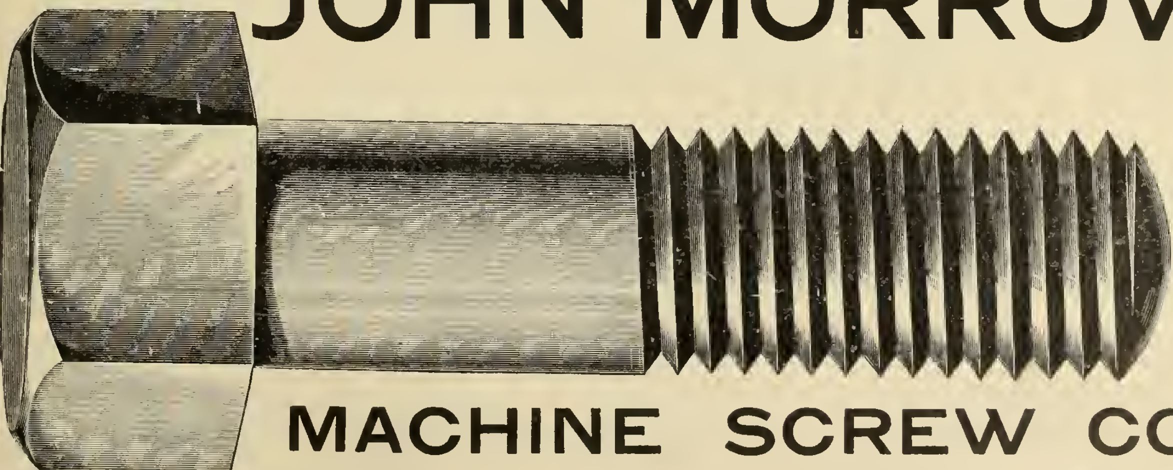

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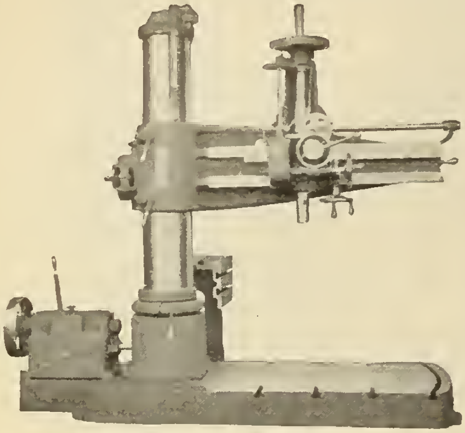

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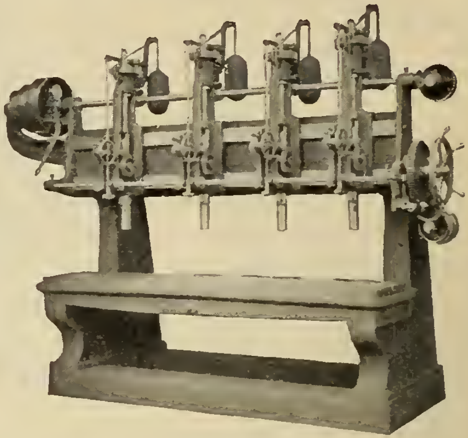

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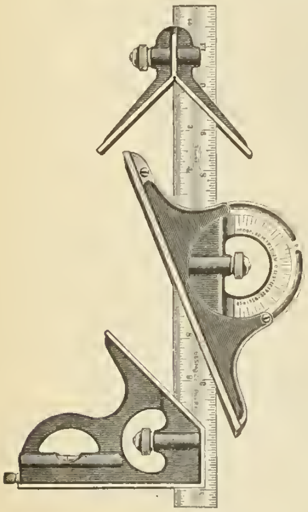

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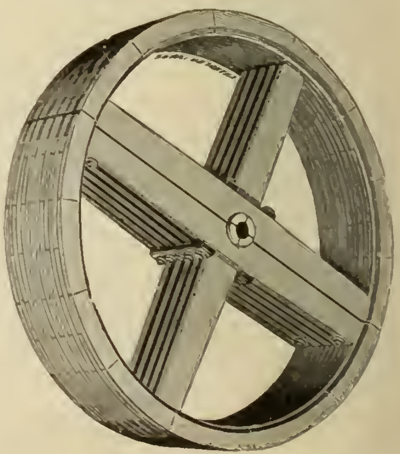

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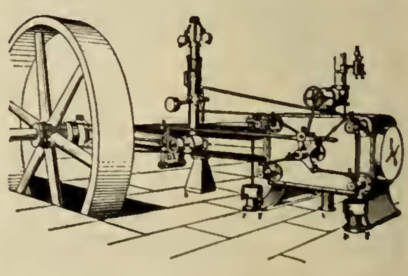
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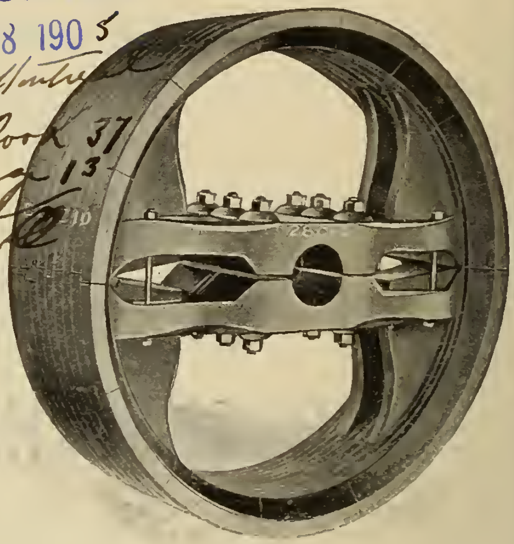

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Power as a Factor in Manufacturing

By J. C. ARMER.

IN these days of keen competition among manufacturers, it is essential that nothing be done in a haphazard way in the hope that it may be all right ; it is essential that the manufacturer know exactly his position, otherwise he cannot meet competition with an assurance of success. This is an age of science, and being such, it is necessarily an age of mathematics. The exact cost of every article turned out of his plant should be known by the manufacturer, and to this end a record of expenses of all kinds should be kept for each department. Then the manufacturer has at his finger ends exact records of his plant, and is thus in a position to make changes and improvements when he sees that such would be profitable. Nor should a manufacturer stint a little time and expense in finding out whether his plant is being run to the best advantage, considered from the two standpoints, efficiency and economy.

Power Efficiency and Economy.

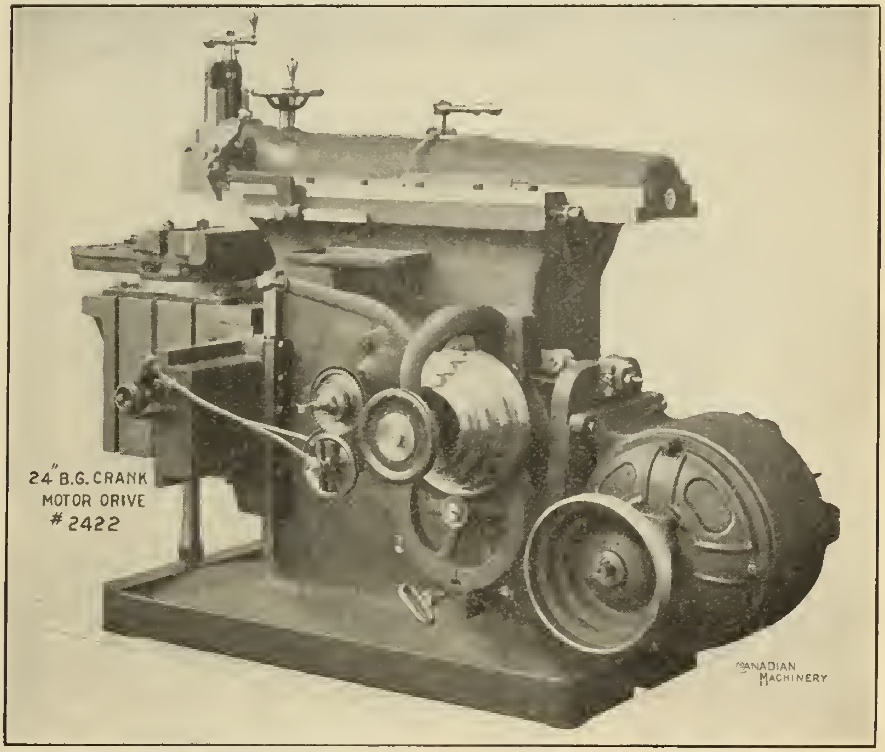
Power is an important consideration in manufacturing, and herein will be discussed a few of the most important points to be investigated when considering the question of power. Broadly speaking, there are two things to be taken into account, efficiency and economy; nor should the manufacturer make the mistake of sacrificing the former for the latter, because economy without regard to efficiency is a non-economic policy.

Sources of Power.

The sources of power which practically supply the field in Canada are falling water, coal and gasoline. Of these three, one would naturally say that the first is the desirable one, and so it is in the great majority of cases, but not in all. The inconstancy of the supply and the chance of a famine often make it advisable to pass the water-power by. However, generally speaking, lucky is the manufacturer with water-power at his disposal.

The chief use of coal for power purposes is as a fuel to generate steam directly, but there is another use to which it is being put for power purposes, which has attracted no little attention of late, not only in Canada and the United States, but also in Britain. Already throughout Canada there are a number of manufacturing plants wherein are installed generating retorts for the production of what is known as producer gas from coal, which gas is burned at jets under boilers instead of coal. It is claimed by advocates of this scheme that a greater amount of heat units can be transferred from the coal to the water in this way than by using the coal directly as a fuel. This is, of course, now undergoing practical tests, and it is the opinion of the writer than more will be heard of it later.

Of late years, gasoline has come into very general use for power units of small size. It would be most convenient to discuss gasoline engines under the general classification of combustion motors, which, of course, include gas engines and all oil engines. The reason for the employment of the combustion motor for units of small size is because of its simplicity as compared with the steam engine. Consider for a moment the requirements of the two. It is requisite for the steam engine that the temperature of the water be raised to the boiling point at the required pressure and maintained there in order that the steam may be generated. That requires so many heat units. At the same time, the flue gases must be allowed to escape to the atmosphere at a temperature sufficiently high to give a good draft, or else a small power unit and blower must be installed to supply a mechanical draft. That consumes so many more heat units. The internal combustion motor realizes many of the requirements of an ideal motor in that its fuel, a hydrocarbon gas or liquid, can be mixed with air in the right proportions and fed directly to the cylinders, where it is ignited explosively so as to be raised instantly to its highest temperature point by an intermittent source of heat, such as the electric spark. Thus, if the fuel used is gas, the motor consists of a cylinder and driving gear, and, if a liquid, a chamber for producing the gas in addition. Thus it is that the explosive motor affords the high power efficiency it does in proportion to its total size and weight. Gas engines of immense size are now being built and used, but these large units are used only where the gas can be secured as a by-product of some industry, such as smelting, where the gases from the blast furnaces are led down and purified in immense pipes and used chiefly in the heating of the furnaces, in which is heated the air blast for the furnace, but also for power purposes.

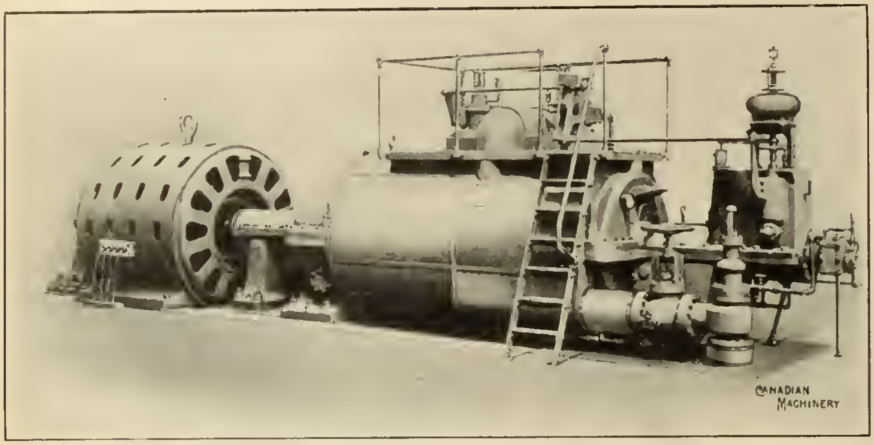


Motor Driven Cincinnati Shaper.

A manufacturer decides that he will generate so much power. According to existing conditions and the amount required, he will choose one of the following methods of generation: from falling water, by means of water turbine; from

coal by means of boiler and steam engine, using the coal as fuel or gas produced from coal as fuel; or by means of internal combustion motors, using gasoline or some kind of gas as fuel.

In choosing the means of generation, the question of heating the building should have due consideration, and very often this would prove the deciding factor. Where the power plant is of sufficient capacity the entire heating load



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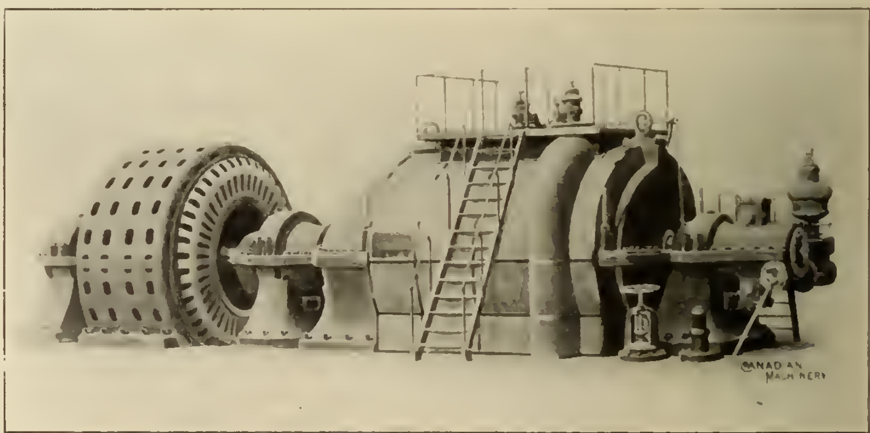
might be carried by the exhaust steam and in any case the exhaust is an important auxiliary in the heating system, and should receive consideration as such.

Distribution of Power.

Now comes the question of the distribution of that power to the different parts of the plant where it is required, and this naturally opens the discussion upon mechanical and electrical power. This topic is so broad and comprehensive that the most superficial discussion of it must be taken up in sections. Then let us first consider the question of transmission and application of energy in the manufacturing plant.

There are two ways of doing this, the mechanical and the electrical; that is the power may be transmitted by a line or lines of shafting and applied to the machines by means of belting, or it may be transformed into electrical energy by means of the electric dynamo, and transmitted by wires and applied to the machines through electric motors, which transform the electrical into mechanical energy. The outlay for electrical transmission is very much greater than for the mechanical, and in considering the question the interest on the investment and the depreciation in value would have to be considered.

In comparing the economy of the two systems the per cent. of the total load required to drive the shafting, and the efficiency of the dynamo and motors would have to be known. Electrical machinery is very efficient, varying from 75 to 80 per cent. in units of 2 horse-power to 93 per cent. in large units. Let us suppose that the dynamo has an efficiency of 90 per cent. and the motors used have an average of 80 per cent. This would mean a combined efficiency of 72 per cent. Let us suppose, on the other hand, that the shafting requires 30 per cent. of the total load, which is probably a fair average per cent. Now, let us suppose that 1,000 horse-power is full load of the power unit employed to supply power. Then when running under full load the shafting would supply 700 h.p. to the machines, and the electrical transmission would supply 720 h.p.; when running under a 75 per cent. load the shafting would deliver 150 h.p., since the shafting would still take up almost the 30 per cent. of full load, amounting to



7500 h. p. Westinghouse-Parsons Turbine Generating Unit.

300 h.p., while the motors would deliver 540 h.p., since the efficiency would still be approximately 72 per cent. of load carried ; under a 50 per cent. load the shafting would deliver 200 h. p., while the motors would deliver 360 h. p. This speaks for itself, and the conditions supposed being quite possible, the figures should carry some weight.

Mechanical and Electrical Drive in Machine Shop.

So much for the economy, let us now consider the efficiency of the two systems of transmission, restricting the meaning of efficiency to ability to perform work required. Probably the best way to compare electrical and mechanical drive would be to consider a specific kind of manufacturing plant. In choosing the machine shop, for consideration, it is well to remember that the special field of the electric drive is the machine shop, and for that reason it would have been fairer to mechanical drive to consider some other style of plant. However, in the machine shop are exemplified so strongly the good points of the electric drive, that it is chosen.

If a manufacturing plant is to be supplied with power by means of shafting it is necessary that the power house be centrally situated, in order that as little power as possible be lost in shafting, and in the design of the different departments their position relative to the power house must have due consideration. Because of this the buildings cannot be arranged to the best advantage for the economic transference of material from one to another. If the electric drive is used the position of the power house is not a consideration, and consequently the position of the departments relative to each other need only be considered.

Now let us consider the machine shop. If mechanical drive is used the positions of machines are limited, since the position of the shafting is settled; and also the machines must be stationary. If electric drive is used the machines may be placed wherever most convenient, and can be moved from place to place with very little trouble, the moving of a machine requiring only the adjusting of connecting wires. In the case of a large piece of work it is very often more convenient to bring the tool to the work than to move the work, and quite frequently it is possible to employ more

than one machine tool on the work at the same time.

In mechanical drive a tool is started by shifting a belt from the loose pulley onto the cone pulley, and to stop the tool the belt shifter must again be resorted to. Those who have had much experience with lathes, started and stopped in this way, will probably recall times when it would have been convenient to have arms two or three times their natural length. In starting a motor driven tool all that is required is to move a handle across the face of the starting box, which can be placed on the tool where most convenient for the operator.

In the mechanical drive changes of speed are made by means of cone pulleys, and of a necessity the changes are made in steps, no speed in between, which can be obtained. With the electrical drive change of speed is obtained by changing the voltage across the terminals of the motor. With the multi-voltage system of control and a rheostat practically any speed within the set limits may be obtained.

Because of the relatively low efficiency and the relative high cost of very small electric motors, it is often advantageous to group small machine tools and run them from a short line of shafting driven by an electric motor.

A machine shop load is a very variable one, and often there are times when the shop would be running under half, quarter, or even a smaller fraction of full load, and thus if electric drive were used, the saving in shafting-consumed power would be considerable.

Canadian manufacturers of electrical machinery have convincing evidence of the growing popularity of the individual motor drive in a review of their trade during the past year, with some the demand for motors for individual drive being the feature of last year's trade.

In different style of plants there are entirely different conditions to be met, and, of course, the relative efficiency of mechanical and electrical drive must be judged according to those conditions.

Should it Be Generated or Purchased?

Now, let us suppose that the consideration of existing conditions at a manufacturing plant has led to the adoption of electric power. Now arises the question of obtaining that power. It may be generated on the premises or it may be purchased from some central distributing station. According to existing conditions at the plant, electric energy may be obtained from one of the mechanical motive powers before referred to, but the consideration will here be restricted to steam.

As to whether it would be more economical to purchase or produce the power at the plant depends almost entirely upon what agreement can be made with the management of the central power station, regarding price, etc. However, there are a few things besides the normal price which should be considered.

Of course, it is understood, that in comparing costs the standing as well as running expenses of the power house are considered. The standing expenses would include rental for space, interest on money invested in machinery, and annual depreciation in value of machinery. The running expenses would include cost of fuel, etc., attendants' time, and cost of repairs.

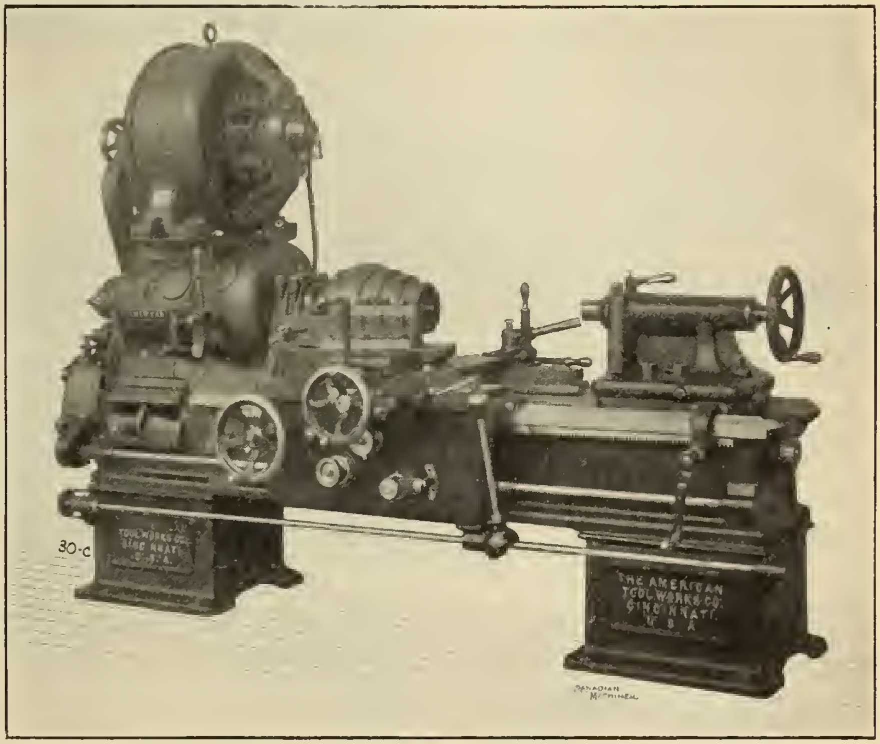
Now let us touch on the points which would not be considered directly under cost. Unless the local plant is equipped with reserve machinery there is always the possibility of the factory being tied up owing to some break down in generating machinery. Since in a great many cases the shutting down of a factory for the time required for repairs would mean a considerable loss, the possibility of such an occurrence should not be excluded from calculations. However, by the installation of the most reliable generating machinery this risk is minimized until probably it is on a par with the risk of power being cut off from the central distributing station.

The question of the heating of the plant is an important one and should not be neglected. If power is secured from a central station boilers will have to be installed for the heating alone. If the power is produced at the plant the exhaust steam from the engine may be utilized to carry the whole heating load or as an auxiliary, according to the amount of steam used in the engine.

Lighting and Power Loads.

If it is decided to install generating machinery at the plant, the capacity of the plant comes up for consideration. There are the two loads to be provided for, power and light. The power load is fairly constant throughout the working hours of the day, but the lighting load, under ordinary conditions, is concentrated during a small fraction of the working hours, and thus if the equipment is a single generator it will have to be of sufficient capacity to carry this peak load, while for the greater part of the time it will be running under the power load only. Of course, to get the greatest efficiency from an electric generator, it must be run at approximately full load all the time, and therefore it is a question for consideration whether it would not be cheaper to buy lighting power than to pay the interest on the larger installation and stand the loss of efficiency owing to the generator running on a fraction of its full load for the greater part of the time. The deciding factor would be the relative amounts of the two loads.

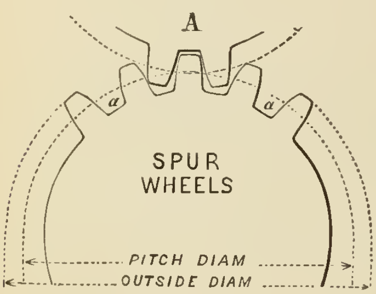
This difficulty, however, might be satisfactorily overcome by the use of storage batteries, as they are now used in all large power plants to store up energy when the load is light, and supply power for the peak loads.

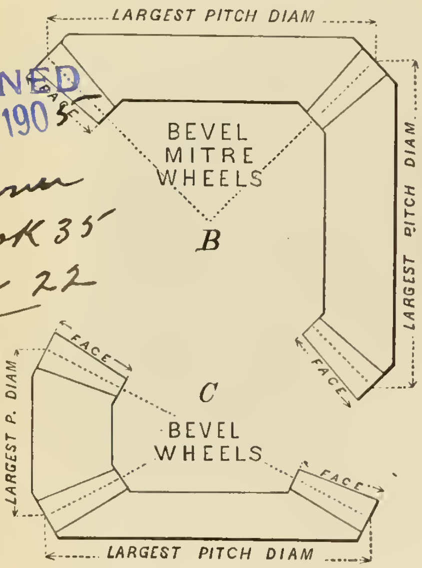


American Lathe, with Motor Drive.

Bevel Gears and Gear Cutting.

THE curve of teeth in bevel gears, when correctly formed, changes constantly from one end of the tooth to the other. Therefore bevel gears, whose teeth are produced with a cutter of fixed curve, are not theoretically correct, the cutter usually being of a curve that will make the correct form at the outer part of the face of the gear, and of necessity will leave the curves too large at the inside ends of the teeth. Small bevel gearing is almost universally produced in this manner, which practically answers the purpose,





except when the teeth are very coarse or the gears very small, in which cases their operation is not satisfactory. In place of cutting by changing position of cutter, etc., the teeth are often filed slightly, in order to round them off to the curve required for their free running. On all bevel gears cut with a cutter of fixed curve, it is necessary to cut through twice, owing to the necessity of making the thickness of the cutter on the pitch line equal to about .005 in. thinner than the space between the teeth at the smallest pitch diameter. As the width of space between the teeth on the largest pitch diameter should be greater than the thickness of the cutter, it must be made so by passing the cutter through the second time.

The cuts shown herewith will explain the forms of spur, bevel and mitre gears, also the terms "pitch diameter," "outside diameter," "largest pitch diameter," "length of face," etc. When a pair of bevel gears are of same size and

20 P 18 P 16 P

14 P 12 P

10 P 9 P

number of teeth, with their lines of centres at right angles, they are called "mitre gears," and one cutter will answer for both; but where one gear has a greater number of teeth, or differs in bevel from the one running into it, then each of the pair of gears may require a different cutter.

Such is the practice of the Brown & Sharpe Co., Providence, R. I., whose cuts are used in illustrating this article, as set forth in their catalogue. Rules given by them for ordering bevel gears include mentioning the following: Pitch, or if preferred, diameter of pitch circle; number of teeth in gear and number of teeth in pinion; diameter of hole in gear and diameter of hole in pinion; backing for both gear and pinion; width of face; diameter of gear hub and diameter of pinion hub, if these dimensions are important, of course; distance of centre of pinion shaft to end of gear hubs; distance from centre of gear shaft to end of pinion hubs; keyway or set-

8 P

7 P

screw, and what size; to be used for pattern or not; whether the pinion drives or is driven.

The Sizing and Cutting of Gear Wheels.

The diameter, when applied to gears, is always understood to mean pitch diameter. The diametral pitch is the number of feet to each of a pitch diameter. Example: If a gear has 40 teeth and the pitch diameter is 4 inches, there are 10 teeth to each inch of the pitch diameter and the diametral pitch is 10, or, in other words, the gear is 10 diametral pitch.

Diametral pitch required, circular pitch given. Divide 3.1416 by the circular pitch. Example: If the circular pitch is 2 inches, divide 3.1416 by 2 and the quotient, 1.5708, is the diametral pitch.

Diametral pitch required, number of teeth and outside diameter given. Add 2 to the number of teeth and divide by the outside diameter. Example: If the number of teeth is 40, the diameter of the blank is 10½ inches; add 2 to the number of teeth, making 42, and divide by 10½; the quotient, 4, is the diametral pitch.

Circular pitch is the distance from the centre of one tooth to the centre of the next, measured along the pitch line. Example: If the distance from the

6 P

5 P

centre of one tooth to the centre of next tooth, measured along the pitch circle, is ½ inch, the gear is ½ inch circular pitch.

Circular pitch required, diametral pitch given. Divide 3.1416 by the diametral pitch. Example: If the diametral pitch is 4, divide 3.1416 by 4 and the quotient, .7854 inch, is the circular pitch.

Number of teeth required, pitch diameter and diametral pitch given. Multiply the pitch diameter by the diametral pitch. Example: If the diameter of the pitch circle is 10 inches and the diametral pitch is 4, multiply 10 by 4 and the product, 40, will be the number of teeth in the gear.

Number of teeth required, outside diameter and diametral pitch given. Multiply the outside diameter by the diametral pitch and subtract 2. Example: If the whole diameter is 10½ and the diametral pitch is 4, multiply 10½ by 4 and the product, 42 less 2, or 40, is the number of teeth.

Pitch diameter required, number of

teeth and diametral pitch given. Divide the number of teeth by the diametral pitch. Example: If the number of teeth is 40 and the diametral pitch is 4, divide 40 by 4 and the quotient, 10, is the pitch diameter.

If the outside diameter or size of gear

4 P

3 P

blank required and the number of teeth and diametral pitch given add 2 to the number of teeth and divide by the diametral pitch. If the number of teeth is 40, and the diametral pitch is 4, add 2 to the 40, making 42, and divide by 4. The quotient is $10\frac{1}{2}$, which is the whole diameter of the gear or blank. To find thickness of tooth at pitch line divide the circular pitch by 2 or 1.57 by the diametral pitch. For example, if the circular pitch is 1.047, or the diametral pitch is 3, divide 1.047 by 2, or 1.57 by 3, and the quotient, .523 in., is the thickness of 2. Again, if the whole depth of tooth is required, divide 2.157 by the diametral pitch. Thus, if the diametral pitch of a gear is 6, the whole depth is 2.157, divided by 6, which equals .3595; or the whole depth of 2 is about 11-16, or exactly .6866 of the circular pitch. If the circular pitch is 2 the whole depth of tooth is about 11-16 of 2 in., or $1\frac{3}{8}$ in. nearly. When it is required to find the distance between centres and two gears, add the number

$2\frac{1}{2}$ P

of feet together and divide one-half the sum by the diametral pitch. For example, if two gears have 50 and 30 ft., respectively, and are 5 pitch, add 50 and 30, making 80; divide by 2 and then divide the quotient, 40, by the diametral pitch 5, and the result, 8 in., is the central distance.

Determining Gear Dimensions.

Let P denote the diametral pitch, or the number of teeth to one inch of diameter of pitch circle.

- " D′ " the diameter of pitch circle. (Larger Wheel.)
- " D " " whole diameter.
- " N " " number of teeth.
- " V " " velocity.
- " d′ " " diameter of pitch circle. (Smaller Wheel.)
- " d " " whole diameter.
- " n " " number of teeth.
- " v " " velocity.

(These wheels run together.)

- " a " " distance between the centres of the two wheels.
- " b " " number of teeth in both wheels.
- " t " " thickness of tooth or cutter on pitch circle.
- " D″ " " working depth of tooth.
- " f " " amount added to depth of tooth for rounding the corners and for clearance.
- " D″ + f " the whole depth of tooth.
- " x constant 3.1416.
- " P′ circular pitch or the distance from the centre of one tooth to the centre of the next on the pitch circle.

2 P

The examples placed opposite the formula following are for a single wheel of 12 pitch, 6.166 in. or 6.2-12 in. diameter, etc., and in the case of the two wheels the larger has the seme dimensions. The velocities are respectively 1 and 2.

FOR A SINGLE WHEEL.

Formulas. Examples.

$$P=\frac{N+2}{D}=\frac{72+2}{6.166},\ \text{or}\ \frac{72+2}{6\ 2\text{-}12}=12. \qquad 1.$$

$$P=\frac{N}{D'}=\frac{72}{6}=12. \qquad 2.$$

$$D'=\frac{D\times N}{N+2}=\frac{6.166\times72}{72+2}=6. \qquad 3.$$

$$D'=\frac{N}{P}=\frac{72}{12}=6. \qquad 4.$$

$$N=P\ D'=12\times6=72. \qquad 5.$$

$$N=P\ D-2=12\times6.166-2,\ \text{or}\ 12\times6\ 2\text{-}12-2=72. \qquad 6.$$

$$D=\frac{N+2}{P}=\frac{72+2}{12}=6.166,\ \text{or}\ 6\ 2\text{-}12. \qquad 7.$$

$$D=D'+\frac{2}{P}=6+\frac{2}{12},\ \text{or}\ 6+.166=6.166. \qquad 8.$$

$$t=\frac{1.57}{P}=\frac{1.57}{12}=.130. \qquad 9.$$

$$D''=\frac{2}{P}=\frac{2}{12}=.166,\ \text{or}\ 2\text{-}12. \qquad 10.$$

$$f=\frac{t}{10}=\frac{.130}{10}=.013. \qquad 11.$$

$$D''+f=.166+.013=.179. \qquad 12.$$

$$P'=\frac{x}{P}=\frac{3.1416}{12}=.262. \qquad 13.$$

$$P=\frac{x}{P'}=\frac{3.1416}{.262}=12. \qquad 14.$$

FOR A PAIR OF WHEELS.

$$b=2aP=2\times4.5\times12=108. \qquad 15.$$

$$n=\frac{DV}{v+V}=\frac{108\times1}{3}=36. \qquad 16.$$

$$N=\frac{n\ v}{V}=\frac{36\times2}{1}=72. \qquad 17.$$

$$n=\frac{NV}{v}=\frac{72\times1}{2}=36. \qquad 18.$$

$$N=\frac{DV}{V+V}=\frac{108\times2}{3}=72. \qquad 19.$$

$$n=\frac{PD'V}{v}=\frac{12\times6\times1}{2}=36. \qquad 20.$$

$$V=\frac{n\ v}{N}=\frac{36\times2}{72}=1. \qquad 21.$$

$$v=\frac{N\ V}{n}=\frac{72\times1}{36}=2. \qquad 22.$$

$$v=\frac{PD'V}{n}=\frac{12\times6\times1}{36}=2. \qquad 23.$$

$$D=\frac{2a(N+2)}{b}=\frac{2\times4.5\times(72+2)}{108}=6.166. \qquad 24.$$

$$b=\frac{2a(n\times2)}{b}=\frac{2\times4.5\times(36\times2)}{108}=3.166. \qquad 25.$$

$$a=\frac{b}{2P}=\frac{108}{2\times12}=4.5. \qquad 26.$$

$$D=\frac{2av}{v\times V}=\frac{2\times4.5\times2}{3}=6. \qquad 27.$$

$$d'=\frac{2aV}{v\times V}=\frac{2\times4.5\times1}{3}=3. \qquad 28.$$

$$a=\frac{D+d'}{2}=\frac{6+3}{2}=4.5. \qquad 29.$$

The East Mine, Brookfield, Queens, N.S., has, after a period of non-producing, again come to the front. There is a 20-stamp mill on the property which has commenced to crush. For a long time the pay streak was lost.

Feed Water System for Boilers and Shop Heating.

*By A. A Mayer, Master Mechanic G. T. R. Shops, Montreal.

SOME three years ago at the locomotive works of the Grand Trunk Railway, at Montreal, on account of a shortage of steam supply, due to increased demands, a system was inaugurated of conveying the exhaust steam from the stationary engines, steam hammers and pumps to condensers from which the water flows into hot wells and is then pumped through superheaters and delivered to the boilers at a temperature near boiling point.

Formerly the water was delivered by injectors at a temperature of about 65 degrees, but on account of the greatly increased temperature, due to the use of this waste heat, the results were such that instead of a steam shortage, although forcing every boiler to the extreme limit, we were enabled to shut down several and yet maintain a satisfactory pressure.

By an approximate rule for the conditions of ordinary practice, a saving of one per cent. is made by each increase of eleven degrees in the temperature of the feed water, and, according to this rule, the saving in fuel is about thirteen per cent., with a still further inclination to save due to less fuel handled, boiler attendance, etc.

The system as we have it in operation at Montreal is shewn on the diagram, figure 1.

To the left is shewn an 8 in. cast iron receiver pipe A, which conveys the exhaust steam from the stationary engines, steam hammers, etc., each engine or hammer having its exhaust pipe coupled to this receiver by means of a Y connection B, having a 1 in. branch which, by means of a reducer, can be coupled to any size of exhaust pipe.

At our blacksmith shop one of these receiver pipes runs the entire length of the shop, about a foot below the ground surface, having twelve connections from engines and hammers, and discharges into a jet condenser C. Inside of this condenser there is a funnel-shaped plate with a centre opening about 10 in. diameter just above the manhole. Jets of cold water are arranged to play upon this plate, condensing the steam as it comes in contact with the plate and cold water.

A few inches below the manhole, a circular angle iron supports a bed of charcoal, carried on a perforated plate, the charcoal being covered with a fine copper mesh, which is cleaned off at regular intervals.

This is for the purpose of separating impurities from the water of condensation, which then flows through the purifying bed to the bottom of the condenser and thence to the hot well.

The exhaust from one of our large engines is passed in at the bottom of superheater D, and thence to the condenser by pipe E.

The pump is set into a pit as low as bottom of the well from which the water flows by gravity to the pump, and having therefore no suction duty to perform, it simply forces the hot water through the superheater and thence to the boilers.

It frequently happens that the exhaust steam comes into the condenser in greater volume than it pays to condense it all, and when the floating indicator in the well shows that the hot water is about to flow over and go to waste in the drain, the condensing water is cut off and the uncondensed steam passes out at the top of the condenser to the atmosphere by means of the 10 in. galvanized pipe F.

Aside from the saving effected by capturing and utilizing this waste heat, which used to escape by numerous pipes through the roofs, presenting a very unsightly appearance, we eliminate to a

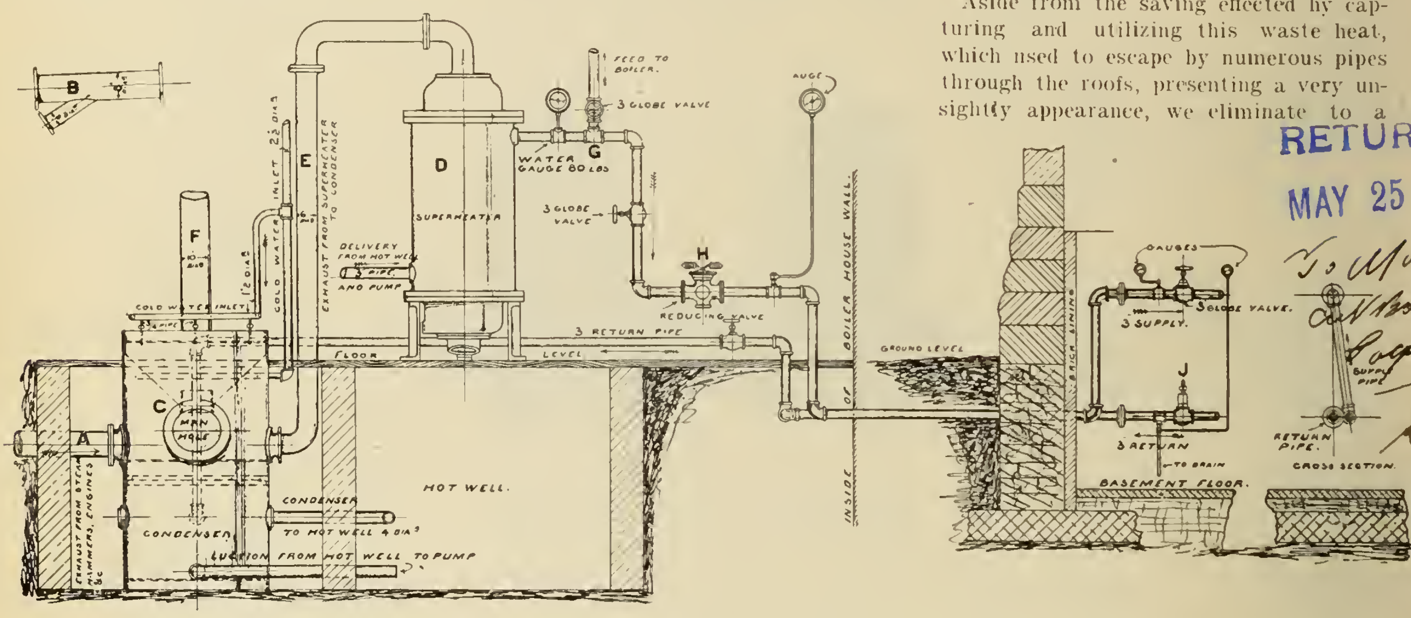


Fig. 1.

large extent the trouble we formerly experienced during the Winter season, caused by icicles forming along the eaves, particularly by condensation thrown from steam hammers; these icicles obscured the light and were often the cause of broken windows when they fell; but since the disappearance of the exhaust steam the shop externally presents a clean, tidy appearance, in marked contrast with its former appearance, especially during the Winter season.

After the system which has just been described had been in operation for some months it occurred to the writer that, as we had such an abundance of hot water, it might advantageously be used for heating purposes, and accordingly it was decided to connect one of our hot

* Read before the Canadian Railway Club, Montreal March, 1905.

feed water pumps to the existing system of hot water radiators in the motive power offices, which had hitherto been heated by a furnace in the basement, and annually consumed some seventy tons of anthracite coal, besides all the attendant work in connection with the furnace, handling of coal, ashes, and dirt, and dust throughout the building. This building is 60 ft. by 60 ft., with four floors and a basement, and stands isolated about 200 yards from the works.

The connection was made by putting a tee fitting G on the feed pipe to boilers and beyond this a reducing valve H was attached to reduce the pressure. A 3 in. flow pipe and 3 in. return pipe were laid in a box about a foot below the ground level. On the return pipe a valve J was placed to regulate the return water, which requires to be faster when the temperature is low.

A retaining valve having a spring screwed down to resist a pressure of some fifteen pounds greater than the head of water in the building was put on the return pipe at a convenient point between the regulating valve and the condenser. The object of this retaining valve is to ensure the whole system being kept full and under pressure, thereby preventing air being drawn in.

When this building was heated by the basement furnace frequent complaints were made about low temperature during severe cold weather, but the water now pumped through the radiators is so much higher in temperature that 75 degrees can be steadily maintained during zero weather.

The results were so satisfactory in every way that it was decided that the Railway Y.M.C.A. building, which was under construction, should be heated in a similar manner. This building is about 150 feet long by about 50 feet wide, and is situated across the street from the motive power offices and has three floors and a basement.

The heating system of this building is connected to the same 3 in. pipe which conveys hot water to the motive power offices; but on entering the building it discharges into a 5 in. pipe, and about the centre of the building this pipe rises vertically, carrying the water to the ceiling of the top floor, where it discharges into a 4 in. pipe which runs the entire length of the ceiling, having a number of 2½ in. branches on either side running to the side walls and dropping to the radiators of each floor, finally discharging into the return pipe in the basement, and is conveyed back to the condenser. An additional pump was installed on account of the increased duty, and they are connected so that if one of them is under repairs the other will keep up the circulation.

This arrangement has given satisfactory service during the past two severe Winters. It differs from that of the motive power offices, where the water is forced upward through the radiators, it being thought that the downward flow through the radiators would be better adapted for this forcing system, but experience has shown that they are equally satisfactory.

By this scheme the Railroad Y.M.C.A. was relieved of the expense of installing heating furnaces, and also the much greater expense of providing fuel annually for heating purposes. The new Railroad Y.M.C.A. building at Stratford is similarly heated from the works. In the absence of exhaust steam, when the works are closed, the well is heated by live steam.

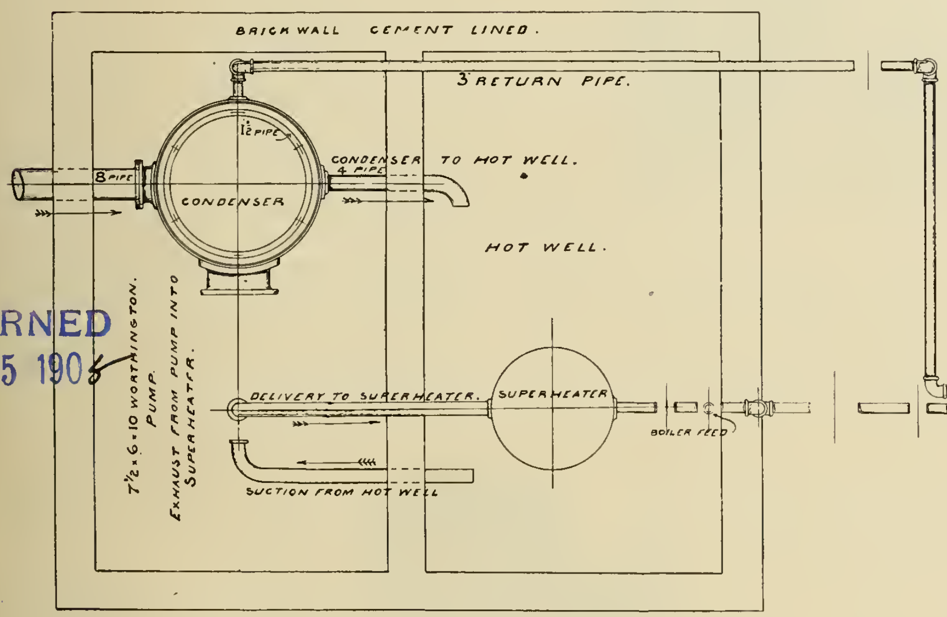
A large portion of the Montreal works is now heated by this method, which is being gradually adopted throughout the system for workshops and roundhouses, with certain modifications to meet local conditions. Where the supply of exhaust steam is limited, the condenser is dispensed with. Within the past year or two, five new roundhouses have been built at various points on the system, which are very satisfactorily heated in the following manner:

The exhausts from the stationary engine, air compressor and pump, are passed through the superheater and thence direct into the hot well; the water is then pumped through the superheater, and after circulating through the heating coils returns to the well.

Steam blown from locomotives is discharged direct into the well. The temperature of these roundhouses is such that engines are soon thawed out, permitting of necessary repairs and cleaning being done; and in addition to this, the house being comfortable and warm, the whole roundhouse staff renders more efficient service than when working in discomfort, and the engineers and firemen are attracted to spend their spare time working about their engines, as is the custom with many during the Summer, but which only the most faithful and devoted will do in a cold and draughty building.

We have a pumping station at the river bank for supplying water to the works, where formerly the feed water for the boilers was delivered at river temperature, but since the installation of a condenser, shown as figure 2, a saving has been effected of about seventeen per cent. in fuel.

This spray condenser is 2 ft. 3 in. in diameter by 4 ft. 6 in. in height, and stands on the floor beside the boilers; a perforated pipe to deliver a spray of cold water is inserted into the side of the condenser near the top, the water descending over four plates forming partitions about 8 in. apart, each plate hav-



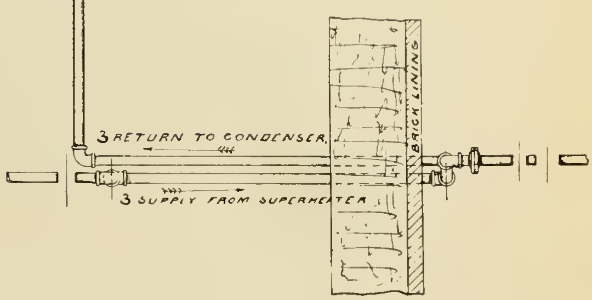


Fig. 2.

ing an opening at one side so arranged that the water follows a zigzag course.

Below these plates and a little below the centre of the reservoir, the exhaust steam from the pump enters, and as it ascends between the plates it is met and condensed by the descending water and with it flows to the bottom through a perforated plate, from which point it is delivered to the boilers by feed pump.

A water gauge glass is applied to the side of the condenser, and the flow of condensing water is regulated to keep the body of the water in the condenser below the entrance of the exhaust steam; a pipe to the atmosphere permits of the escape of excess steam.

This arrangement has proven so satisfactory that authority has been given to have a similar device applied to road pumping stations, and when this has been done, a station or any company's house within a reasonable distance of the pump house may be heated by the boiler feed pump in the manner already described.

A pipe of comparatively small dimensions will suffice to carry the hot water to the building to be heated, but the pipe to which the branches are connected should be of such ample proportions as will insure the branch at the furthest extremity being properly fed; in other words, it should be considered as a reservoir to feed the branches.

Shortage of steam and the heating of buildings is a vexed question with many, and to those who are grappling with it this description of how the matter has been dealt with may convey some suggestions which will produce equally beneficial results.

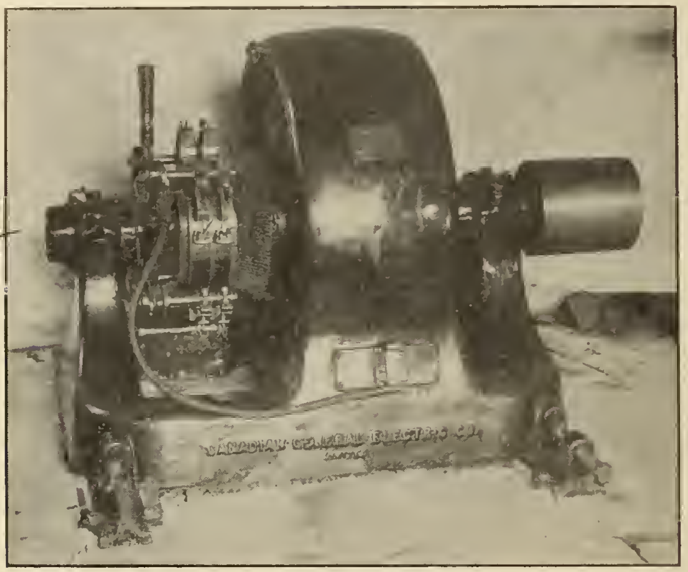
An engineer declares that 50,000 people now do work with the aid of machinery which needed 16,000,000 persons to do a few years ago.

ILLUSTRATING MACHINERY

PROBABLY in no other one line does the average artist find it so difficult to please his client as in illustrating machinery.

The reason is obvious.

The "average" artist is not a mechanic or even mechanical. He does not recognize accurate and exact rendering of material or photographic perfection of detail and construction as desirable, while the client appreciates that these features are not only desirable, but absolutely essential if the illustrations are to be of any commercial value to him.



Before Retouching.

It is only within a comparatively few years that this necessity for photographic perfection has resulted in the old-fashioned wood cut being practically superseded by the half-tone process plate, for machine reproductions.

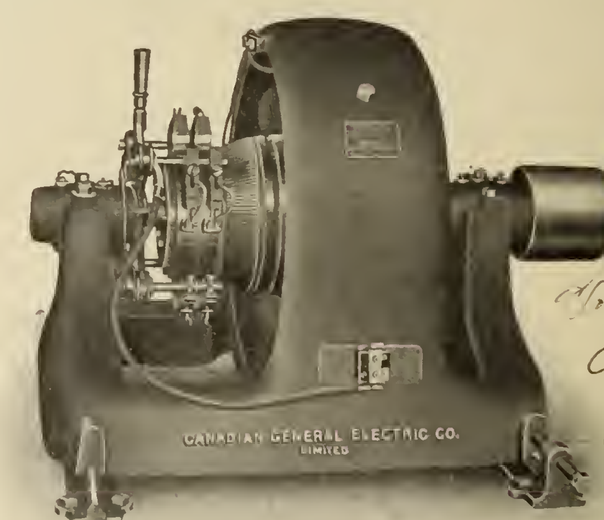
It must not be inferred, however, that it is only necessary to get a photograph of a machine to assure a perfect reproduction for advertising purposes.

Perfection in the finished half-tone plate requires a careful "retouching" of the photograph to eliminate all the defects inherent in the photo-print proper, and, if necessary, even those in the machine itself, for these are often magnified apparently a hundred fold by the photographic process which will sometimes bring out distinctly some slight discoloration, hardly noticeable to the naked eye.

The quality of this "retouching" is so important as to admit of its being entrusted to specialists only and a competent retoucher must be not only a clever artist, but thoroughly familiar with mechanical detail and construction as well, and the quality of the finished product will usually be found to be in exact ratio to the artist's command of these qualifications.

The illustrations shown are from cuts made by Grip, Limited, Toronto and Montreal, and give an idea of the excellent results that can be obtained by retouching, even when the photograph is taken under very adverse circumstances.

The illustrations shown herewith were supplied by the Canadian General Electric Co., Toronto, whose advertising manager, H. O. Edwards, was one of the first advertising men in Canada to appreciate the value of high-grade illustrations for the advertising of machinery.



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After Retouching

Engineers' Club, Toronto.

On May 11th the topic for discussion at the Toronto Engineers' Club was "A Smokeless City," by A. M. Wickens. A smoker will be held on Thursday, May 25th.

Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

ELECTRICALLY-TEMPERING TOOL STEEL.

In telling of various ways of hardening and tempering high-speed tool steel, in a paper on "The Development and Use of High-speed Tool Steel," read at the New York meeting last Fall, of the Iron and Steel Institute, and already noted in these pages, J. M. Gledhill presented several diagrams illustrating different electric tool-heating methods. These are reproduced herewith as of additional interest, and for the sake of convenience some of the previously printed data are also given here.

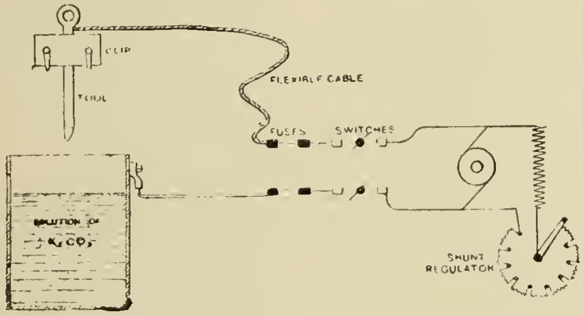


Fig. 1.—Apparatus for Hardening High-Speed Tool Steel.

Fig. 1 shows the apparatus intended specially for heating the points of tools. It comprises a cast-iron tank containing a strong solution of potassium carbonate and a dynamo, the positive cable from which is connected to the metal clip holding the tool to be heated, while the negative cable is connected direct to the tank.

After switching on the current, the tool is gently lowered into the solution to the depth to which it is to be hardened. The dipping of the tool into the solution completes the electric circuit, and at once produces intense heat at the immersed part. When it is seen that the tool is sufficiently heated, the current is switched off, and the solution then serves to rapidly chill and harden the point of the tool.

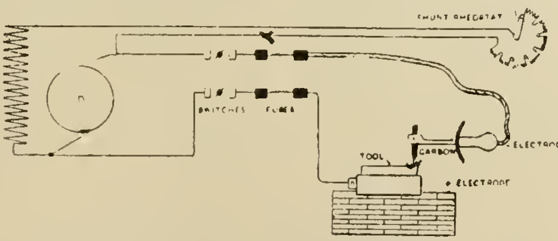


Fig. 2.—Heating the Points of Tools by the Electric Arc.

Another method of heating the points of tools is by means of the electric arc after the manner illustrated in Fig. 2. In Fig. 3 is shown the area of the tool subjected to the arc effect. The tool under treatment and the positive electrode are placed on a bed of non-conducting and non-combustible material and the arc is started gradually at a low voltage, being steadily increased, as required, by controlling the shunt-wound motor at from 50 to 150 volts. Arcs from 10 to 1,000 amperes are then easily produced and simply and safely controlled by means of the shunt-rheostat.

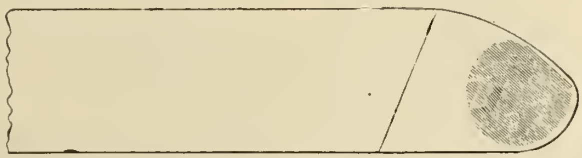


Fig. 3.—The Shaded Part Shows the Area of Electrical Contact. The Negative Electrode Should be Kept Moving Over the Surface Without Approaching Too Near the Cutting Edge of the Tool.

In the case of tempering such forms of tools as milling, gear, hobbing and other similar cutters; also large hollow taps, hollow reamers, and all other hollow tools made of high-speed steel, where it is required to have the outside or cutting portion hard, and the interior soft and tenacious, so as to be in the best condition to resist the great stresses put upon the tool by the resistance of the metal being cut, and which stresses tend to cause disruption of the cutter if the hardening extends too deep, the apparatus shown in Fig. 4 is used. Tempering of hollow cutters, etc., is sometimes carried out by the insertion of a heated rod within the cutter, and so drawing the temper, but this is not entirely satisfactory or scientific, and is liable to induce cracking by too sudden heat-application, and further because of the difficulty of maintaining the necessary heat and temperature required, and afterwards gradually lowering the heat until the proper degree of temper has been obtained.

In electrical tempering, the rod is placed inside the cutter quite cold, and the electric current gradually and steadily heats up the rod until the correct temperature is reached, when it can be held at such temperature as long as is necessary, and the current can be gradually reduced until the articles operated on are cold again, and consequently the risk of cracking by too sudden expansion and contraction is reduced very greatly.

The apparatus used is very simple, as will be seen by reference to the sketch. It consists of a continuous current shunt-wound motor directly coupled to a single-phase alternating current dynamo of the revolving-field type; giving 100 amperes at 350 volts and 50 cycles per second, the exciting current being taken from the works supply main.

By means of a transformer the generator current is stepped-down to 2 volts, the secondary coil of the transformer consisting of a single turn of copper of heavy cross section, its extremities being attached to heavy copper bars which carry the connecting vises holding the mandril upon which the cutter to be tempered is placed.

Although the resistance of the complete circuit is very low, still, owing to the comparatively high specific resistance of the iron mandril, the thermal effect of the current is used up in heating the mandril, which gradually attains the required temperature, slowly im-

parting its heat to the tool under treatment until the shade of the oxide on the tool satisfies the operator.

The method adopted to regulate the temperature of the mandril is by varying the exciting current of the alternator by means of the rheostat. An extremely fine variation and a perfect heat control are easily possible with this arrangement.—The Electrical Age.

HOW TO REMEMBER THE WIRE TABLE.

THE wire table for the B. & S. gauge copper wire has a few simple relations, such that if a few constants are carried in the memory the whole table can be constructed mentally with approximate accuracy.

Resistance—A wire which is three sizes larger than another wire has twice the weight and half the resistance.

No. 10 wire has a resistance of 1 ohm per thousand feet; No. 7 wire, which is three sizes larger, has .5 of an ohm per thousand feet; No. 4 wire, which is three sizes larger than No. 7, has .25 of an ohm; No. 13 wire, which is three sizes smaller than No. 10, has 2 ohms; No. 16 wire, which is three sizes smaller than No. 13, has 4 ohms. It is easy, therefore, knowing the resistance of No. 10, to find the resistance of No. 7, No. 4, No. 1 and No. 000; also of No. 13, No. 16, No. 19, etc.

A wire which is ten sizes larger than another wire has ten times the weight and one-tenth the resistance.

As the resistance of No. 10 is 1 ohm per thousand feet, the resistance of No. 0 is .1 of an ohm, and the resistance of No. 20 wire is 10 ohms. As the resistance of No. 4 is .25 of an ohm, the resistance of No. 14 is 2.5 ohms and of No. 24, 25 ohms.

In the following table the first column contains the sizes of wire which differ from one another by three sizes. The

Size.	ohms.	Size.	ohms.	Size.	ohms.
No. 1	.125	No. 11	1.25		
No. 4	.25	No. 14	2.5		
No. 7	.5	No. 17	5	No. 0000	.05
No. 10	1	No. 20	10	No. 0	.1
No. 13	2	No. 23	20	No. 3	.2
No. 16	4	No. 26	40	No. 6	.4
No. 19	8	No. 29	80	No. 9	.8
No. 22	16	No. 32	160	No 12	1.6
No. 25	32	No. 35	320	No. 15	3.2

resistance of each wire in this column is seen to be twice that of the next larger size and one half that of the next smaller size. There is, therefore, no difficulty in remembering this column. In the second division of the table the wires first division; thus No. 11 corresponds to No. 1 and the resistance is ten times are ten sizes smaller than those in the as great. In the third division of the table the wires are ten sizes larger than those in the first division; thus No. 0 corresponds with No. 10 and the resistance is one-tenth as great.

From this table several new relations may be observed.

If the wire is one size smaller the resistance is 25 per cent. greater. For example: Compare No. 11 with No. 10, No. 12 with No. 11, No. 13 with No. 12, etc.

If the wire is two sizes smaller the resistance is 60 per cent. greater. For example: Compare No. 12 with No. 10, No. 16 with No. 14, No. 15 with No. 13.

If the wire is one size larger the resistance is 80 per cent. of that of the smaller wire. For example: Compare No. 9 with No. 10, No. 10 with No. 11.

If the wire is two sizes larger the resistance is 63 per cent. of that of the smaller wire. For example: Compare No. 11 with No. 13, No. 4 with No. 6.

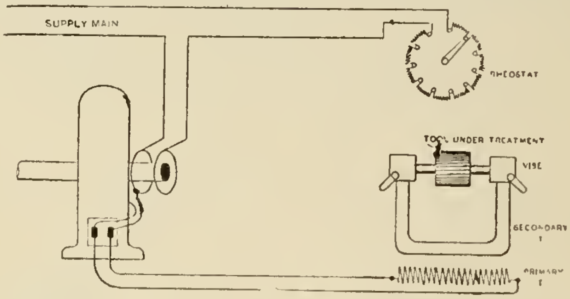


Fig. 4. Tempering Milling Cutters.

From the foregoing the following are the ratios of resistance between wires of consecutive sizes:

.50, .60, .80, 1.00, 1.25, 1.60, 2.00.

Weight—The weight of a wire is inversely proportioned to its resistance. Therefore, the foregoing relations are the same for weight as for resistance, excepting that the weights increase as the size of the wire increases, instead of diminishing. The weights of successive sizes of wire, therefore, bear the following relation, beginning with the smaller wire:

.50, .63, .80, 1.00, 1.25, 1.60, 2.00.

If the weight of any size of wire is known, it is therefore seen that the weight of the next larger size is 25 per cent. greater; the weight of the second larger size is 60 per cent. and the weight of the third larger size is double; also, the weight of the sixth larger size will be four times as great, and the weight of the tenth larger size will be ten times as great.

The weight of 1,000 feet of No. 10 copper wire is 31.4 pounds. Therefore, the weight of No. 7 wire is 62.8 pounds; the weight of No. 0 wire is 314 pounds. The weight of No. 5 wire is 100 pounds per thousand feet, which is a convenient figure to remember. The weight of No. 2 wire is, therefore, 200 pounds, and the weight of No. 00 wire is 400 pounds.

Area—The area of No. 10 wire is approximately 10,000 circular mils (more precisely 10,380). The area is proportional to the weight. The area of No. 7 wire is, therefore, about 20,000 circular mils, of No. 0 wire 100,000, and of No. 0000 wire 200,000. The precise area of No. 10 wire is 10,380 circular mils. Taking this figure for easy calculation as 10,400 and following the process above indicated, the area of No. 000 wire is found to be 208,000, which is very nearly 211,600, the figure in the wire table.

Diameter—The diameter of No. 10 wire is approximately 0.10 inch (more precisely 0.102 inch). The diameters follow the same ratio as the circular mils and weights except that this ratio applies to alternate sizes. Therefore the sixth smaller size has half the diameter and the twentieth smaller size has one-tenth the diameter. Therefore, as No. 10 is 0.10 inch, No. 16 is 0.05 inch and No. 30 is 9.91 inch; also No. 4 is 0.20 inch and No. 000 is 0.40 inch; also No. 0 (two sizes smaller than No. 000) has 80 per cent. less diameter, or 0.32 inch. No. 00, lying between these sizes, may be presumed to be about 10 per cent less than No. 000, or .36 inch; the diameter given in the wire table is 0.3648.

Reference to a complete wire table will show that the figures in the above examples and other figures which may be determined in the same way are correct within a few per cent. A little practice in mental arithmetic will enable anyone to determine the approximate weight and resistance of wire of any size.

Summary—The things to be remembered regarding B. & S. gauge copper wire are the following:

A wire which is three sizes larger than another wire has half the resistance, twice the weight and twice the area. A wire which is ten sizes larger than another wire has one-tenth the resistance, ten times the weight and ten times the area.

No. 10 wire is 0.10 inch in diameter (more precisely 0.102); it has an area of 10,000 circular mils (more precisely 10,380); it has a resistance of 1 ohm per thousand feet at 20 degrees Centigrade (68 degrees Fahrenheit), and weighs 32 pounds (more precisely 31.4 pounds) per thousand feet.

The weight of one thousand feet of No. 5 wire is 100 pounds.

The relative values of resistance (for

decreasing sizes) and of weight and area (for increasing sizes) for consecutive sizes are:

.50, .63, .80, 1.00, 1.25, 1.60, 2.00.

The relative values of the diameters of alternate sizes of wire are:

.50, .63, .80, 1.00, 1.25, 1.60, 2.00.

Circular Mils—Conductors of large size are usually specified in circular mils. For example, 500,000 circular mils, 750-000 circular mils.

As No. 10 wire has approximately 10:-000 circular mils and a resistance of 1 ohm per thousand feet, and as the length of a wire which has a given resistance is proportional to its area, it follows therefore that the length in feet of a copper conductor having a resistance of 1 ohm may be found by dropping one cipher from the number expressing its circular mils; for example, No. 10 wire has 10,000 circular mils and a resistance of 1 ohm per 1,000 feet; a 300,000 circular mil conductor has a resistance of 1 ohm per 30,000 feet and a 1,000,000 circular mil conductor has a resistance of 1 ohm per 100,000 feet. The weight of a given length is proportional to the area; therefore, the weight of a conductor having 500,000 circular mils is greater than that of No. 10 wire in the same ratio that its area is greater. Five hundred thousand circular mils is fifty times that of No. 10 wire or approximately fifty times 32 lbs., which equals 1,600 lbs. per thousand feet. In this way the approximate characteristics of copper conductors of all sizes may be quickly ascertained.

To find resistance, drop one cypher from the number of circular mils; the result is the number of feet per ohm.

To find weight, drop four cyphers from the number of circular mils and multiply by the weight of No. 10 wire.—Electric Club Journal.

CARBON USED AS RESISTANCE MATERIAL.

IN many instances, carbon is used as the resistance material as in curling irons, in which a thin pencil of carbon consuming 25 watts, is placed in the circular tongue, which is usually made of aluminum. A pencil of carbon is also used in one of the latest types of radiators, which consist of lamps about 10 in. long and 2½ in. in diameter. The contained carbon filament is about 1-16 in. in diameter, and about 13 in. long, being bent in the middle to form a single loop, each lamp consuming about 250 to 300 watts, with usually four lamps in each radiator.

Furnaces of the Borchers type also use a carbon pencil as the resistance. A small pencil of carbon 2 in. long and ⅛ in. diameter with conical ends is held in position by two very large carbon rods having conical recesses in the end of each. When a current is passed through the combination, the pencil of carbon is elevated to a white heat, fusing the mass of material which has previously been spread round it.

The following table is interesting as showing the efficiency of various sources of light:

Efficiency of Various Sources of Light.

Source of Light.	Total Consumption of Energy in Watts required to produce a light of one Candle.	Ratio of Luminous to total Radiation, or Luminous Efficiency.
Candle..............	86 watts	2 to 3 per cent.
Oil lamp............	57 "	3 "
Petroleum lamp......	42·8 "	3 "
Argand gas lamp	68·8 "	4 "
Electri glow lamp...	3½ "	3 to 7 "
Electric arc..........	0·3 "	5 to 15 "
Magnesium wire	....	15 "
Electric discharge in rarefied gases....	....	33 "

One of the most useful sources of heat is the electric arc, which is used extensively in many metallurgical and chemical processes. It is also used in a few domestic and similar appliances. Professor Ougrimoff, of Moscow, has designed a water heater of 98 per cent. efficiency, in which he uses the electric arc to splendid advantage. This heater, which can be used for many chemical processes and distilleries, consists of a crucible of cast iron in the bottom of which is placed powdered graphite. Above this crucible and regulated by a wheel and worm-screw is a large carbon rod, which is connected to the positive pole, the crucible being connected to the negative pole, so that when the arc is set up, the greater heat will be produced in the crucible. The heating chamber, chiefly consisting of the crucible, is, with the exception of the top, surrounded by the water to be heated, and when the arc is struck, the resistance of the graphite is sufficient to prevent short circuits. The arc is also used in soldering irons which are made under the Byng patents in this country.

Another type of electric heater which is well worth mentioning, and that is the electric welder.

The heating effect being proportional to the square of the current, by transforming a high pressure current of small amperage down to one of low pressure and high amperage, it can be used to soften or melt any metal required. From 10,000 to 40,000 amperes per square inch are generally allowed for welding purposes. This welder is an automatic one for welding the links of chains. The chain is fed in at one side with open links and leaves, the other side with the ends of each link welded. Automatic welders are made by this firm for welding bars, rings, spokes to wheels, and ornamental work on to their frames.

A welding transformer weighing 1,000 lbs., is used for softening Harveyised armor plates upon which some work is required to be performed after they have been hardened and placed in position. The current is gradually raised to about 10,000, and with a surface of ½ square inch, then gradually decreased so that the portion heated shall be soft when the current is entirely switched off.

A method used for raising bars of metal to a welding temperature is to dip them into a lead-lined tank containing an aqueous solution such as potassium carbonate or borax, and the heat caused by the high resistance film of hydrogen which is evolved at the positive pole to which the rod of iron is connected, soon raises it to a temperature sufficient to melt the metal and cause it to run off from the end of the bar.—Page's Weekly.

MAGNETIC TESTING OF IRON.

IRON which is to be used for electrical purposes must possess properties quite distinct from those which give it its value for ordinary mechanical uses so that to determine its suitability for the former work some method of testing it is necessary which will give information bearing upon the end in view. The enormous amount of iron low being used in the construction of dynamo armatures, transformers, etc., renders the question of the suitability or otherwise of certain brands of the greatest practical importance, in order that the efficiency of the apparatus may be as high as possible, and its behavior agree with previous expectation. The two properties which are particularly desirable in transformer iron, or any iron subject to reversals of magnetism, are a high permeability of high magnetic induction in the iron due to a given magnetising force, and, secondly, as small a loss by hysteresis as possible when the magnetism is reversed. The hysteresis loss in watts may be approximately calculated by an empirical formula due to Steinmetz, who found that, in general, it varied as the 1-6 power of the induction density, or it may be measured in the case of any given sample directly by a wattmeter. But the permeability is usually determined by noting the change of induction due to the reversal of a known magnetising force. The change of induction sets up a proportional instantaneous current in the coil of wire surrounding the specimen, the magnitude of which is indicated by the swing of a ball galvanometer in circuit with the coil. The galvanometer having previously been calibrated with a standard air coil, a numerical value for change induction can be obtained, and the ratio this bears to the change of magnetising force is a measure of the permeability of the iron. —Proc. Inst. El. Eng.

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

SMALL INSTRUMENTS OF MEASUREMENT.

NEVER before have engineers and mechanics possessed such a wealth of measuring instruments as they have at their command to-day. The manufacture of these necessarily lies in the hands of a few specialists, for, before a single accurate instrument can be produced, an expensive plant must be laid down and must be backed up by an extended experience in all that the manufacture involves. The problems met with in very fine measurements are far from being new, but their application to engineers' tools is mainly a development of the present generation.

It is an interesting fact that though so fine a difference in dimensions as a millionth of an inch could he detected by a feeling piece in the original Whitworth measuring machine, yet the finest tests for measurement are made by microscopic vision.

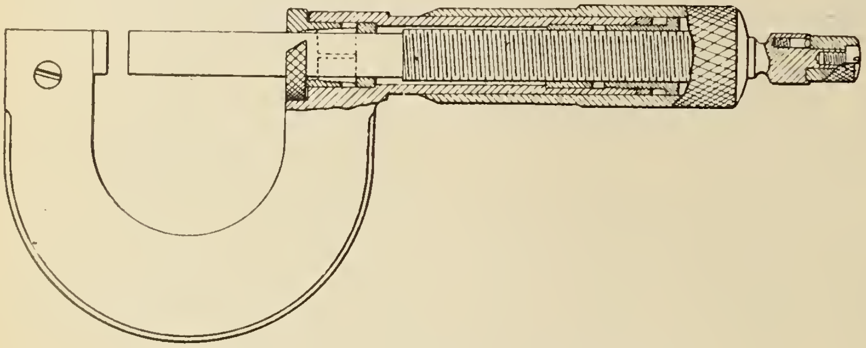


Fig. 1.—Method of Taking up Wear and Slip Ratchet.

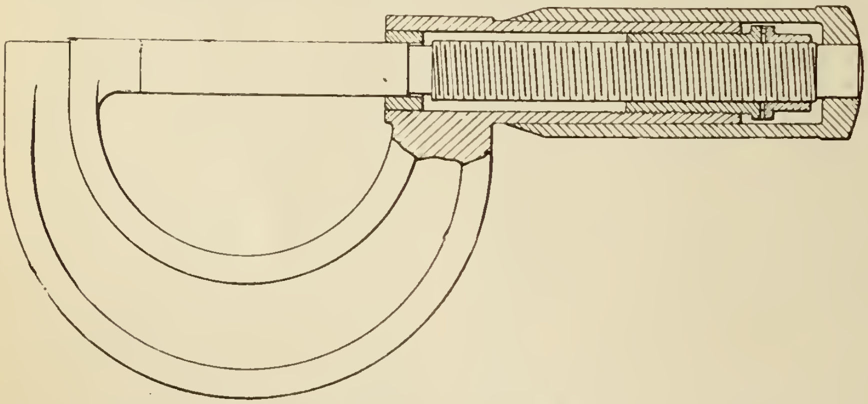


Fig. 2. Method of Taking up Wear on Micrometer.

The place of gauged measurement is that of fixed and unalterable dimensions often repeated. That of direct rule measurement lies either in the manufacture or test of standards, or in the test of sizes that are not emhodied in the standard gauge.

For much of the ordinary work of the shops the rule is accurate enough, but not so when fine dimensions or very precise, though comparatively coarse, limits are required. It is very difficult to work within 0.01 inch by the common rule, but 0.001 is not fine enough for the highest grades of work. Hence we have here the parting of the ways between the gauges depending on the sense of touch and the instruments which emhody the application of direct vision. Both now constitute immensely large groups, each including many varieties, but the broad division stated is that which seems most natural to adopt, for however greatly the individual forms vary, they can either be classified under one of these great groups, or they embody a combination of both in one instrument.

Measuring instruments for direct reading are represented primarily by the common rule. The divisions on a rule, though apparently simple, are the result of a long series of experiments and precautionary measures, having for their object the production of standards.

The common rule calls for no particular observations, as it is not a fine instrument of measurement. It is used for measurements which are rough by comparison with those effected by the gauges, and is employed chiefly in lining out work for the machines.

To make the rule an instrument of precision, it must be combined with something embodying special provision for minute measurement, as a sliding gauge, fitted with a vernier, or micrometric additions. The result is the same whichever of these methods of fine subdivision is adopted, each being applied indifferently to calipers and movable gauges of various types. In each 0.001 inch can be read off precisely without magnification and halved with a little careful scrutiny. But the instruments so modified fall out of the category of rules proper, because the application of these refinements is only adaptable to comparatively short dimensions. They do not, therefore, take the place of the common rule in the work for which it is chiefly employed, but supplement it in checking small dimensions, and so do in variable sizes what the fixed gauges do for fixed dimensions.

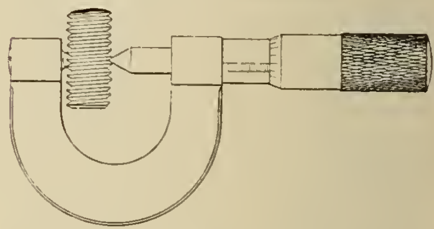


Fig. 3.
Micrometer Caliper, for Measuring Screw Threads.

There is, however, a vast deal of work lying within the range of these sliding calipers. Both vernier and micrometer fittings are put on similar instruments, such as calipers, and depth gauges, and sometimes the calipers include compass points. The micrometer is also applied to rod gauges for bores. The methods of fitting by different makers are varied with price and ideas. Many of the German instruments differ in design from those made in America, possessing details not found in the latter.

When instruments are designed to measure precisely to 0.001 inch, an obvious difficulty is the retention of that accuracy in spite of wear. This is one of the details in which the designs of micrometers vary. The instrument has a plain appearance outwardly, but, when

taken apart, the complexity of some devices is apparent. Some examples of these are shown.

Fig. 1 shows the method of taking up wear of the screw in the micrometers. The barrel, which is one with the arm,

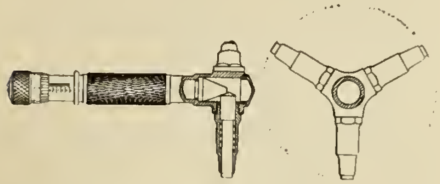


Fig. 1.—Internal Micrometer Gauge.

is bored to receive three sleeves. One situated at about the centre receives the micrometer screw. Another behind it, similarly threaded internally, is also threaded externally to fit within the barrel and is provided with a lock-nut by which it is clamped after the adjustment for wear has been made, the thimble being removed for this purpose. The screw threads in the end collar and lock-nut are finer than those of the micrometer screw, to secure the fine adjustment. The plain, or measuring, end screw, and to fit a thread of another pitch on the interior of the barrel. A nut behind is used for adjustment on the removal of the thimble, retaining its position by fine ratchet teeth milled upon the abutting faces of both nuts. A fine coiled spring, occupying a recess between the two, maintains an even tension.

Fig. 3 shows a special form of the micrometer caliper used for screw gauging. It is more delicate than the ring gauges used for a similar purpose, because it does attempt the almost impossible task of perfect contact all round the circle and at all sections of the thread. The points and roots of threads do not affect the result, since measurement is taken down the sides and at one-half the depth of the thread.

The micrometer is fitted to internal rod gauges, being a refinement on the rigid gauges which are used for measuring bores. The objection to these forms is that unless care is exercised in setting them exactly across the diameter, the reading will not be exact. Lately

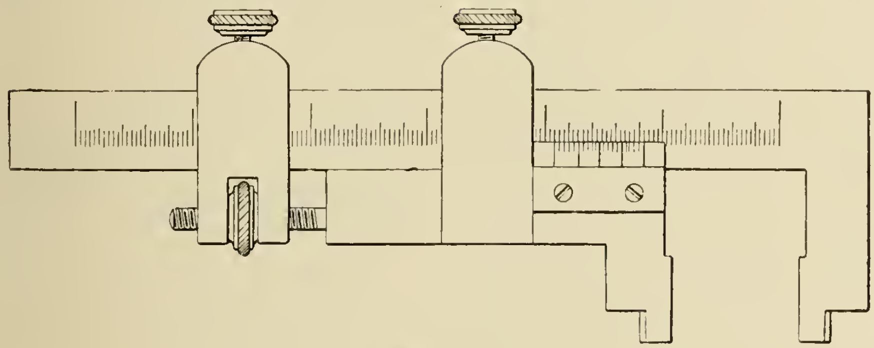


Fig. 5. Vernier Caliper.

of the screw spindle receives a split ring, which is closed around it, in spring chuck fashion, by the knurled nut, so locking the spindle after setting to a size.

The ratchet device at the right-hand end comprises a spring pawl, which produces just sufficient friction to allow the thimble to be revolved, but slips when the work is touched by the measuring point. A uniform pressure is thus ensured, which eliminates the personal element, since no two men will use quite the same pressure in turning an ordinary screw, which may be tightened too much or not enough.

Fig. 2 shows a micrometer in which

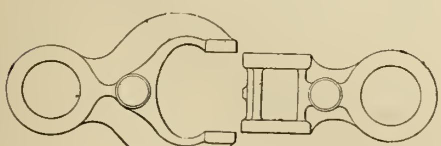


Fig. 6.—Separate External and Internal Strap Gauges.

the differential screw principle is also embodied, but in a different fashion. The barrel receives a bush at its rear end, which is threaded to fit the micrometer they have been improved, as in the instrument with three equi-distant measuring points, shown in Fig. 4. Each point is moved in unison by the conical end of the micrometer spindle, contact with which is maintained by means of springs.

Fig. 5 shows the vernier caliper which resembles the beam micrometers in its capacity for measuring a length of several inches, combined with thousandths. It has means of fine adjustment for such settings by a separate head fitted with a fine screw and nut. Internal, as well as external, measurements can be taken. The details in design of these are varied and numerous.

The most absorbing present question, and one that affects all departments of machine shop practice, is that of limits of tolerance, and how they can best be determined and embodied. These vary in different shops, and in the same shops on the different classes of work done, and yet the present need for economical production renders necessary the application of gauged methods in every shop, without exception, in all cases to which gauging can be applied. Hence the great importance of the determination of suitable limits for different classes of work. Let us see in brief what this involves.

Hardening is essential, following annealing and rough turning. One of the great difficulties encountered is the alterations which take place in the internal structure of the steel, which requires that the roughed-out gauge blanks shall be laid aside for weeks or months to allow such changes to expend themselves, a refinement in manufacture which does not enter into ordinary engineers' work. Cassier's Magazine.

FUEL ECONOMY IN STEAM-POWER PLANT.

(Continued from March.)

SMOKE prevention can often be managed by excessive air admission, for the reason probably that though air in excess has a chilling effect, its ample provision enables all the gases to burn before they have lost much temperature. But smoke cannot be prevented with economy unless sound conditions are present as already detailed, and the crux of the whole matter is summed up by saying that a maximum percentage of CO_2 must be present in the furnace gases.

Steam.

Steam loses heat from the moment it leaves the boiler. The surfaces which contain it must, therefore, be of minimum area. This involves pipes of minimum length and is one of the various reasons for avoiding ring mains, the fancied need for which is obviated by using good materials well put together for steam-piping. Short pipes make it possible to carry a given weight of steam with less drop pressure, or otherwise to carry the same steam at the same pressure fall through smaller pipes.

The loss of heat through pipes varies with the head of temperature. The weight of steam that will flow through a pipe varies with the pressure absolute very nearly. The pressure of steam rises faster than the temperature, and high-pressure steam (realized to be economical) will lose less heat than the low-pressure steam, if the pipes are as much smaller as they should be for the high pressure.

Wet steam travels with more friction than dry steam. Superheated steam, despite its greater head of temperature, loses heat less rapidly by contact than does wet steam; it flows with less friction and loses less at joints. Less of it is required, and pipes may be smaller.

To produce superheated steam has proved more difficult than might be anticipated, owing to the variable conditions of the furnace. To prevent superheated tubes burning away, steam is

often made to rush through them at a high frictional velocity, whereby its pressure being reduced 12.15 and even 25 lbs., much of the gain of superheating is sacrificed. In separately fired superheaters no tube will stand a temperature above, say, 1,400 deg. F. Few will stand more than 1,000 deg. to 1,200 deg. F. But a furnace worked with any regard for fuel economy has a temperature of waste gases of 2,500 deg. or 3,000 deg. F.

In the manufacture of steam fit to be used in an engine, economy demands its production in distinct stages. The water, duly purified, is first raised to the temperature of condensation by the exhaust steam. This may be, say, 100 deg. F. It is next raised to a temperature of, say, 250 deg., 300 deg. or upwards, by means of the residual heat of waste gases.

The boiler should produce steam which contains the maximum possible amount of heat per cubic foot, and is capable of performing work in the smallest possible cylinder. Unfortunately for economy, cylinders are made of material which exchanges heat with the steam, particularly if wet, and, despite all precautions, steam enters the cylinder loaded with water and cannot lose heat without liquefaction taking place.

The Waste Gases.

The temperature and chemical composition of the waste passing from every large boiler plant ought to be regularly ascertained; the work being carried out by a man specially trained in technical gas analysis. The absence of smoke is no guarantee that combustion is being carried out in an economical manner, and only by constant testing of the exit gases can one be certain that the fuel is being burnt, without undue excess of air. The significance of air excess becomes manifest when one considers the following figures:

With gases containing only 4 per cent. of CO_2 and a chimney temperature of 400 deg. F., 4,380 B. Th. units are lost for every pound of fuel burnt; i.e., 32.4 per cent. of the total heat value of the fuel. It may be objected that this percentage of CO_2 is much lower thon that present in the flue gases of electricity works; but the authors believe that this percentage is not exceeded in many works, where no special attention has yet been given to this question, and where no CO_2 testing apparatus has yet been installed.

In nearly every case where automatic or other CO_2 testing apparatus has been purchased and used, the authors know that all the earlier tests have been under 5 per cent. of CO_2 proving that under the every-day conditions of work obtaining in these plants, unduly large volumes of air were being admitted.

Where no economizer is installed, the loss of heating power is even greater, for the gases then pass to the chimneys at a temperature of from 600 deg. to 700 deg. F., and the heat losses rise to 6,570 and 7,665 B. Th. units, or to between 48 and 56 per cent. of the total heat value of the fuel.

Taking now the case where the boiler plant is under scientific control and by constant testing the percentage of CO_2 in the exit gases has been raised to 12 per cent., the loss of heat with chimney gases at 400 deg. F., is reduced to 1,540 B. Th. units, or to 11.4 per cent. of the total heat value of the fuel.

In the one case only, between 44 and 68 per cent. of the heat can possibly be utilized; while in the other 88.5 per cent. of the thermal value of the fuel may be converted into useful work—either in the boilers or in the feed-water apparatus. Engineers would, therefore. be wise to give most careful attention to this question of excess air supply to the boiler furnaces, and to make proper provision for the constant sampling and testing of the exit gases.

Draught, Etc.

A good draught is only an aid to economy when other conditions are good. Too good a draught must not be employed with a thin fire, for it will cause too large an influx of air. Fuel of a large size will stand a powerful draught, but also demands a thick fire.

The production of a chimney draught with a temperature of waste gas, say, 300 deg. F. above atmospheric temperature, points to a consumption of heat about one-ninth of the total heat produced in the furnace. This fact points to the minimum air supply, which implies maximum furnace temperature and best efficiency of heating surface. Under normal conditions, however, from 20 to 30 per cent. of the total heat of coal goes up the chimney. It is claimed that a fan draught can be produced with about 1 per cent. of the total engine power, and that the use of a fan must therefore effect a great fuel saving. A fan will not save fuel unless it enables this to be burned more efficiently as above. A fan draught will give economy if, by its aid, a flue feed-water heater can be installed to reduce the excessive temperature of the flue gases.

Rules for Sampling Fuel.

As each barrow load or fresh portion of fuel is taken from the pile or store heap, a count is kept of the number used, and the whole contents of each tenth or twentieth barrow or portion are placed on one side, in a cool place, under cover. Care must be taken that the barrow or portion selected for the sample does not contain an unfair proportion of lumps or smalls.

At the end of the day, or period for which the sampling is to be carried on, the heap of fuel obtained for sampling purposes, as described above, is transferred to a sampling plate, and the larger lumps are all crushed down to walnut size. Should no sampling plates be available four of the iron plates used for covering manholes and boiler-flues may be utilized to obtain a hard, clean surface on the floor of the boiler house, and the crushing down of the sample may be carried out on these plates with any heavy and flat lump of iron at hand. The heap of fuel, after this first crushing, is thoroughly mixed by turning over and over with a shovel. The heap is then flattened down, two lines are made across it at right angles with the edge of the shovel, and two of the four opposite sections are selected to form the reduced sample. The lumps in this are again crushed, the sample is again mixed, and the quartering operation repeated, until 8 or 10 lbs. of fuel remain, with no lumps that will not pass through a ¼-in. sieve. Two 1-lb. tins, with ordinary or patent lids, are filled from this remaining heap of fuel, after thoroughly mixing the same with the hands or with a small shovel. One of these tins is to be sent per parcel post to the fuel expert for analysis; the other is kept for reference in case of dispute.—Proc. Institute Electrical Engineers.

BURSTING OF PIPE FITTINGS.

THE bursting of cast iron fittings when subjected to steam pressure and struck with a hammer was discussed in a recent paper, read before the American Association for the Advancement of Science, by Prof. D. S. Jacobus, of Stevens Institute. In a case where a man was killed by the bursting of an elbow on a steam main near which he was working, the question arose as to the number of pieces into which such an elbow would be broken if it were struck with a hammer when under steam pressure. Tests were made on fittings of the same size and weight as the one which caused the accident, and on some smaller fittings. The fitting which caused the accident was an extra heavy elbow for a 3-in. standard pipe. The smaller fittings which were tested were of 2-in. standard size and of the ordinary weight. In the tests the elbows were broken by hitting them with a hammer swung by hand, when they were subjected to pressures of 80 and 100 lbs. per square inch. The hammer, together with its handle, weighed 4 lbs. The fittings were struck on the outside directly over each of the screw threads at points directly opposite the neck and in the plane passing through the pipe centres. The extra heavy 3-inch elbows broke in two nearly symmetrical halves, the plane of breakage being that passing through the pipe centres. The 2-in. fittings of ordinary weight broke into two to four or more irregular pieces.—Engineering Record.

The Bicentric Polar Valve Diagram

By JOS. A. FUX*

THE practical value of a valve diagram is indicated by its simplicity and its accuracy.

The well-known Zeuner and Bilgram diagrams are in themselves simple, but not accurate.

The diagrams which give more accurate solutions are too complicated, and therefore difficult to remember.

Mr. F. A. Brix, a naval constructor and engineer, has designed a valve diagram which he calls "Bicentric Polar Diagram," which is as simple as the Bilgram and gives practical and correct solutions. Having used it for several years, and never having seen it published in one of the American papers, I shall give as short an explanation as possible.

To fully understand the diagram we will have to study first the relation between crank travel and piston travel.

R— Crank Radius O A.

L—Length of Connecting Rod.

X—Piston travel from dead centre measured from cylinder end.

—Crank Motion D O A measured from dead centre O D.

r—Throw of eccentric O F.

l—Length of eccentric rod (not shown in figure).

x—Valve travel measured from its dead centre at cylinder end.

—Angle of advance.

e—Outside lap.

a—Width of steam port.

The theoretical piston travel $X_o = R\,(1 - \cos.\ \alpha) + L\,(1 - \cos.\beta)$

THE POLAR CRANK DIAGRAM.

The Valve Diagram under discussion is based upon the polar crank motion diagram shown in Fig. 2. To this figure the point C is a pole located on the piston rod axis DK, at a distance OC from O, the centre of the crank circle DAK, such that

$$OC = \frac{R^2}{2L} \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

from the centre O in the direction of the crank travel from cylinder and towards crank end.

Drawing a line CA identical with the angular crank travel the corresponding piston travel is equal to the distance X. Bringing the projected arc length DA on axis DK and drawing the line OA we find

$$X = R - R\cos.\ AOD = R[1 - \cos.\ (\alpha+\gamma)] \ldots\ldots\ \ldots\ldots\ldots (2)$$

In drawing a perpendicular from O to line CA we have OE. Its equation is

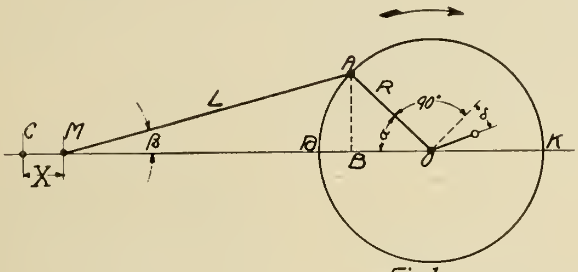


Fig 1.

$$OE = R\sin.\gamma = \frac{R^2}{2L}\sin.\ \alpha$$

Therefore

$$\text{Sin. } \gamma = \frac{R}{2L}\sin.\ \alpha \ldots\ldots\ldots\ldots (3)$$

The difference between equation (2) and the mathematically accurate value of piston travel (derived from Fig. 1):

$$X_o = R(1 - \cos.\ \alpha) + L(1 - \cos.\beta)$$

gives the value of error for the crank diagram Fig. 2.

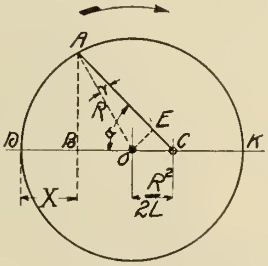


Fig 2.

$$X_o - x = [R(1-\cos.\alpha) + L(1-\cos.\beta)] - [R(1-\cos.(\alpha+\gamma)]$$

$$= R\,[\cos.\ (\alpha+\gamma) - \cos.\ \alpha] + L\,(1 - \cos.\ \beta) \ldots\ldots\ldots\ldots (4)$$

in which angle β can be found from Fig. 1 by

$$AB = L\sin.\ \beta = R\sin.\ \alpha \ldots\ldots (5)$$

We could find the greatest difference (4) with the aid of calculus, but as the difference is so very small we can arrive at a value by the aid of the binominal theorem in developing thus:

$$\cos.\gamma = \sqrt{1 - \sin.^2\gamma} = \left(1 - \frac{R^2}{4L^2}\sin.^2\alpha\right)^{\frac{1}{2}}$$

$$= 1 - \tfrac{1}{8}\frac{R^2}{L^2}\sin.^2\alpha + \ldots\ldots\ldots\ldots (6)$$

and

$$\cos.\ \beta = \sqrt{1 - \sin.^2\beta} = \left(1 - \frac{R^2}{L^2}\sin.^2\alpha\right)^{\frac{1}{2}}$$

$$= 1 - \tfrac{1}{2}\frac{R^2}{L^2}\sin.^2\alpha + \ldots\ldots\ldots (7)$$

According to equations (3), (6) and (7) we find and can write the difference (4) thus:

$$X_o - x = R\cos.\ \alpha\cos.\ \beta - R\sin.\ \alpha\sin.\gamma\ \gamma - R\cos.\ \alpha + L(1 - \cos.\ \beta),$$

$$= R\left(1 - \tfrac{1}{8}\frac{R^2}{L^2}\sin.^2\alpha\right)\cos.\alpha$$

$$\tfrac{1}{2}\frac{R^2}{L}\sin.^2\alpha - R\cos.\ \alpha + \tfrac{1}{2}\frac{R^2}{L}\sin.^2\alpha$$

or

$$X_o - X = \frac{R}{8}\left(\frac{R}{L}\right)^2\sin.^2\alpha\cos.\alpha\ (8)$$

The difference will be zero mark when α is either O°, 90°, 180° or 270°.

The numerical value of cos. α which makes the difference $X_o - X$ an absolute maximum we find from equation:

$$O = (\sin.^2\alpha\cos.\ \alpha) = 2\sin.\ \alpha\cos.^2\alpha - \sin.^2\alpha = \sin.\ \alpha\,(3\cos.^2\alpha - 1)$$

$$\text{Or } 3\cos^2\alpha - 1 = 0\ ;$$

Therefore $\cos.\alpha \pm \frac{1}{\sqrt{3}}$ and $\sin.^2\alpha = \frac{2}{3}$.

These values placed into equation (8) give the largest value of error

$$(X_o - X)\text{max} = \pm\frac{\sqrt{3}}{36}\left(\frac{R}{L}\right)^2 R$$

$$= \pm.0481\left(\frac{R}{L}\right)^2 R$$

and for the different values of R:L we get

R:L	=	¼	1/5
$(X_o - X)$max.	=	±.0031R	±.0019R
		1/6	
		±.0013R	

which would give us a difference of 0.0155 inches in an engine of 10″ stroke and having a ratio of R:L=1:4; this is so insignificant that we can use the diagram drawn out in Fig. 2, and call it practically correct.

THE BICENTRIC VALVE DIAGRAM.

What we have said of the crank travel is equally correct in relation to the valve travel as the eccentric and rod moving the valve is nothing else but a crank and connecting rod moving the valve with the throw of the eccentric as the radius of the crank.

To draw the valve diagram we have

*Chief engineer Waterous Engine Works Co., Brantford.

only to combine the crank diagram with the eccentric as shown in Fig. 3, in which DNKM represents the crank circle with its centre O and dgk f the eccentric with its centre o.

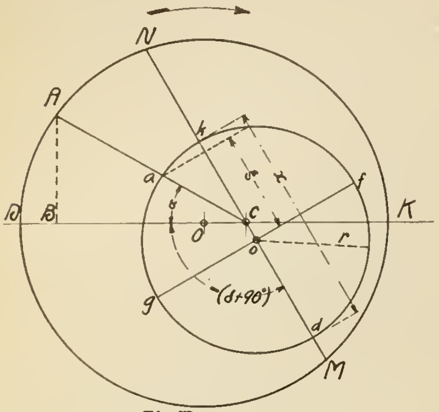


Fig 3.

On the line DK the piston travel is read off and on line dk the valve travel. Line dk passes through the common pole C at an angle of $(\delta + 90^\circ)$ with line of piston travel DK.

In Fig. 3 we have, according to equation (1) $OC = R^2 : 2L$ and $o\,C = r^2 : 2\,l$.

The lineal piston travel X of a crank motion represented by angle $\alpha = DCA$ is found in projecting the point of intersection A on DK. The line of piston travel in our case $= BD$.

Its corresponding valve travel x is the projection of the point a of intersection between C A with eccentric circle on d k

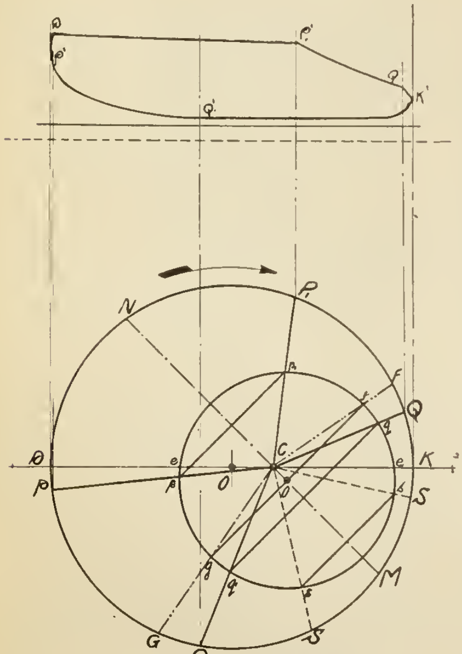


Fig4.

the line of valve travel $=$ d k, the points d and k being the dead centres of the valve at cylinder and crank end respectively. For ordinary use we only want the valve travel g from its central position, which can be readily taken off.

In such cases where the valve is moved by an eccentric with an intermediate rocker arm, or when the inner edges of the valve are the steam distributing factors and directly connected with the eccentric rod, as common in piston valve practice, the eccentric lags $(90 - \delta)^\circ$ behind the crank. To draw that valve diagram we have to turn the eccentric diagram around pole C 180° so that its centre o and valve dead centre d lie in opposite directions to C.

To study the steam distribution of the slide valve with the aid of this diagram we have to introduce into the valve diagram the inside and outside lap as well as width of steam port. Doing so we get a diagram as shown in Fig. 4, which represents the steam distribution at cylinder end of piston.

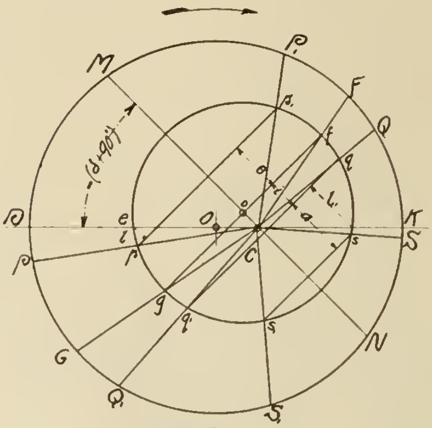


Fig5.

To draw the diagram for the crank end we have only to reverse the diagram, always bearing in mind to place pole C towards crank end of diagram.

Fig. 5 shows a complete valve diagram drawn with the same values of inside and outside lap, etc., as used in Fig. 4 but with the eccentric lagging behind the crank.

In comparing Fig. 4 with Fig. 5 we notice the difference in the position of o and O. The finite lengths of connecting and eccentric rods are represented by the distance between O and o in the diagram.

The greater this distance appears in the diagram the greater will be the difference in the steam distribution at front and crank end of cylinder.

It must, therefore, be our endeavor to design the valve motion of an engine to make the distance O o a minimum.

We learn from the diagram that a valve gear with an eccentric lagging behind the crank will give a more even steam distribution than one with the eccentric ahead, provided all valve rod dimensions are alike.

No other valve diagram will show this important point.

This diagram also gives the peculiarities of valve motions with eccentric ahead or lagging.

In Fig. 4 we see that the steam distribution will be more favorable the smaller the distance $CO = \frac{r^2}{2l}$ is e.i. the larger the length of the eccentric rod l.

Fig. 5, on the contrary, shows that in a valve motion with a lagging eccentric the most favorable steam distribution will occur if O o is perpendicular to C o; we have in that case

$$C\,o = CO \cos DCd = CO \sin.\delta$$

or

$$\frac{r^2}{2l} = \frac{R^2}{2L} \sin.\delta$$

CP Steam enters cylinder.
D Port is open amount et = lead of valve.
CN Dead center of valve; greatest port opening.
CP Steam cut off.
CF Center position of Valve.
CQ Release.
CS to CS, Exhaust port wide open.
CQ Compression begins.
CG Center position of valve.

We procure the best rod and eccentric rod dimensions if

$$\frac{r}{l} = \frac{R}{r} \cdot \frac{R}{L} \sin.\delta$$

In summing up I may say that the execution of this diagram is simple, and as all lines intersect under a sharp angle, the readings ought to be correct.

The Canadian Westinghouse Co., Limited, recently sold to the Edmonton (Alberta) Street Railway Co. a 200-k.w. railway generator and a number of double equipments of railway motors. The City of Edmonton is the most northerly point on the American continent to operate an electric street railway.

Another recent sale made by the Canadian Westinghouse Co., Limited, was that of a 500-k.w. enclosed type turbo-generator unit to the Canadian Pacific Railway Co. This unit is to be installed at Fort William on the Canadian Pacific and to be used for supplying power to the various grain elevators at that point. The unit is to operate 3 phase, 600 volt, 7,200 alternations. 3,600 r.p.m.

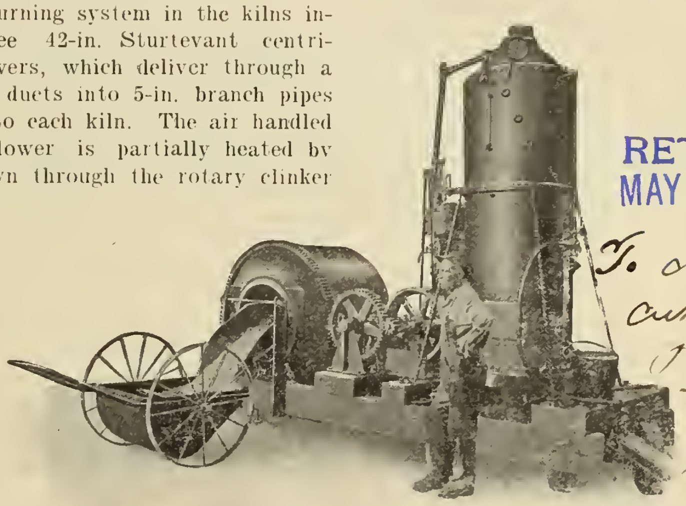
Construction and Improvement

General Construction ***Contractors' Supplies***

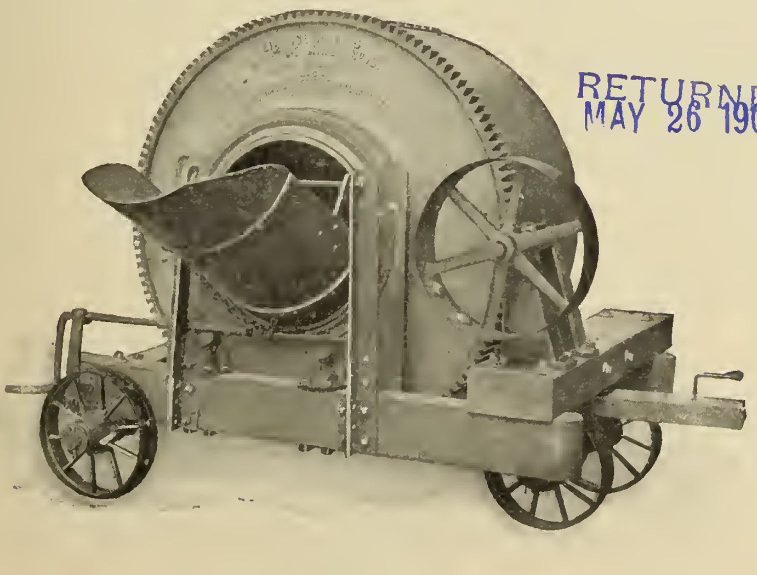
CONCRETE MIXERS.

Illustrations are shown herewith of the Ransome Concrete Mixer, for which F. H. Hopkins & Co., Montreal, are the Canadian agents. These mixers are driven at from 15 to 20 revolutions per min., each revolution giving four complete turns of the material. Under ordinary conditions they will handle concrete at 30 batches an hour, and if equipped with suitable charging hopper will handle 40 to 50 batches an hour.

The mixing drum revolves on four rollers chilled after the manner adopted for the wheels on all railway coaches. These rollers are carried on axles similarly chilled while both rollers and axles are protected against grit by steel guard plates. The operation of discharging a mixed batch of concrete is done by movement of a lever which reverses the tube through which the materials are delivered. The entire batch can be taken from the mixer within 15 or 20 seconds. One special feature of Ransome machines is that they are fed lower and consequently more easily than has been the custom heretofore. Another feature is the readiness with which the machine can be taken down and set up.



Concrete Mixer in Operation.



Ransome Concrete Mixer.

MODERN CEMENT MAKING.

In few lines of industry has the recent introduction of mechanical appliances as substitutes for hand labor been more extensive or effective than in the manufacture of cement. The rotary kiln fed under forced draft with powdered fuel is in effect the essential feature of the new method. In the recently completed plant of the National Cement Works of Martin's Creek, Pa., the apparatus for the coal burning system in the kilns includes three 42-in. Sturtevant centrifugal blowers, which deliver through a system of ducts into 5-in. branch pipes leading into each kiln. The air handled by each blower is partially heated by being drawn through the rotary clinker coolers and thence through the passages where the hot clinker falls from the kiln to the rotary cooler. At the bottom of the pulverized coal bin is provided a special controllable feed device which regulates the quantity of fuel and the proportionate volume of air. Compressed air at 45 pounds pressure is also introduced into the centre of the 5-in. pipe near the kiln end. The entire coal-burning apparatus was furnished by the B. F. Sturtevant Co., of Boston.

DUMPING AMERICAN CEMENT.

Active steps have been taken by the cement branch of the Canadian Manufacturers' Association to protect Canadian manufacturers and prevent the dumping of American cement in this country. At a meeting at which representatives were present from Owen Sound, Hanover, Lakefield, Belleville, and other cement centres, it was decided to send a deputation to Ottawa to secure protection in this line. Cement dealers asked for an increase of 5c. a hundred in the customs duty, which would give them a protection of 17½c. a hundred. No decision has been arrived at regarding the matter.

NEW CEMENT WORKS STARTED.

Within the past month the large new cement works of the International Portland Cement Co. have commenced operations at Hull, where they are turning out a high-class product. Among the officers of the company are: Sir Sanford Fleming, president of the board of directors; A. F. MacLaren, M.P., vice-president, and J. S. Irvin, managing director, and R. D. Hassan, chief engineer. The factory buildings and installation are among the best of their kind, the machinery being the latest that could be secured. The works are situated just outside the City of Hull, where ideal conditions as to availability of raw product exist.

BOOK REVIEWS

"ELEMENTS OF MECHANICS," by Mansfield Merriman, Prof. of Civil Engineering in Lehigh University. New York: John Wiley & Sons. Cloth $1.00 net. A treatise on mechanics for beginners in engineering, including 40 lessons, dealing with concurrent forces, parallel forces, centre of gravity, resistance and work, simple machines, gravity and motion, inertia and rotation, together with an appendix, in all 171 pages. The method of dealing with the subject matter in different lessons, each complete in itself yet leading further, is a feature worthy of note. Each lesson is supplemented by a number of numerical problems dealing with the subject at hand and enabling the student to grasp the matter thoroughly. It requires only a knowledge of plain geometry, elementry algebra and plain trigonometry to master this book.

"A Chapter on Pulleys," published by the Draftsman, Cleveland, Ohio. This is a short description of pulleys dealt with under the heads of Speed, Belts, Rims, Arms, Hubs and Keys, together with some useful tables on dimensions and decimal equivalent.

"A Chapter on Lettering," published by the Browning Press, Cleveland, Ohio. Paper, 25 pages; 25c. This takes up the subject of lettering for mechanical drawing in a practical manner. It is fully illustrated and contains sample styles of lettering, practice sheet, common errors on mechanical drawings, block type, fancy letters, initial letters, monograms, headings and show cards, scrolls and tail pieces, titles on drawings, borders and a title type.

"The Automobile Pocket Book: Compendium of a Gasoline Automobile," by E. W. Roberts, M.E. The Gas Engine Publishing Co., Cincinnati, Ohio. There has been a demand for some time for a book such as this by those interested in automobiling. It is not only a handbook of reference, but a very complete treatise on manufacture and management of automobiles, whether from the viewpoint of the operator or designer. It tells what to do in cases of emergency and contains considerable data relating to designs. Each chapter is as far as practicable complete in itself, while the subject matter is devoid of technical terms and higher mathematics. It contains 319 pages of reading matter; is 3½ in. by 5¼ in.; price $1.50.

"Modern Gas Engines and Producer Gas Plants," by R. E. Mathot, M.E. Published by Norman W. Henley Publishing Co., New York; 300 pages, 175 illustrations; cloth, $2.50. This book is a guide for the gas engine designer, user and engineer, being practical and at the same time covering the field in a comprehensive manner. Neither mathematics nor theoretical considerations are used to any extent. Every part of the gas engine is described in detail, to comply with the requirements of the mechanic. In addition are included helpful suggestions as to the purchase of a gas engine, its installation, care and operation.

"Ferric and Heliographic Processes," by George E. Brown, F.I.C., Tennant & Ward publishers, New York, $1.00 net. A handbook for photographers, draftsmen and sun printers. It deals with the different methods employed in the ferro-prussic processes and the preparation and manipulation of heliographic papers. The book is profusely illustrated with prints made from samples of work by the different processes described.

"How to Handle Freight," by R. C. Richards, General Claim Agent, Chicago and Northwestern Ry. Co. Subject matter of this book was included in an address to the agents and employes of the Chicago and Northwestern Ry. Co. This address is worthy of place in the library of every railroad man, whether he be official or employe, as well as any outside of the railway companies anxious to become conversant with that branch of the business.

"Self-Propelled Vehicles." A practical treatise with illustrations, by J. E. Homans, A.M.; 672 pages, bound in black, gilt top. Theo. Audel & Co., educational booksellers, New York; price $2.00. Over 500 illustrations appear in this book, which contains a large amount of well arranged and useful information, set forth in a manner easily comprehended. It covers the general principles of automobile construction and operation in the opening chapters, followed by an exhaustive account of the theory, construction and operation of gas engines. Several typical engines are taken up and discussed separately. Governing devices and ignition are fully discussed. The important types of gasoline vehicles are described as well as the subject of electricity as connected with electric vehicles.

"Alternating-Current Machinery" in six parts; prepared by Wm. Esty, S.B., Associate Professor of Electrical Engineering, Lehigh University; published by the American School of Correspondence at Armour Institute of Technology. These books deal with the difficult subject of alternating-current machinery in a simple manner, avoiding as far as possible higher mathematics and abstruse formula. Part 1 deals with the simple alternator and discusses the different terms and expressions used in connection with alternating currents. Part 2 opens with chapter on volt meters, followed by a discussion of alternators from elementary theory. Armature windings are explained and commercial types of alternators described, which description continues into Part 3, where the subject of alternator losses, efficiencies, ratings and tests are dealt with. The transformer is next taken up where its laws, connections and tests are dealt with, together with descriptions of commercial type. The rotary converter, the induction motor, synchronous motors, motor generators and repulsion motors, are treated of. Part 6 concludes with description of controller apparatus for alternating-current generator.

"The Fan, Including the Theory and Practice of Centrifugal Fans," by Chas. H. Innes, M.A.; the Technical Publishing Co., Limited, 287 Deansgate, Manchester. A theoretical discussion of the fan with a view to increasing the knowledge of the design and working of fans of different classes. The opening chapter takes up the subject of conservation of energy and losses of head. This is followed by calculations and laws and theoretical characteristics of the fan. The matter of design of different types is considered. Experiments with various types are enumerated according to results in actual practice. The book concludes with a description of special types of fan.

"The Construction of Cranes and Other Lifting Machinery," by Edward C. R. Marks. Technical Publishing Co., Manchester, Eng.; 250 pages; third edition, revised and enlarged. This book is in three parts, Part 1 dealing with notes on general principles and practice in standard type of lifting machines. Herein are described the different types of lifting apparatus used in ordinary practice from pulley blocks, crabs and winches to heavy derrick cranes and overhead traveling cranes. Part 2 describes some patented inventions relating to lifting machinery, and in Part 3 are given examples of present practice by leading makers of lifting machinery. The book is almost entirely descriptive and contains complete and valuable information on the subject of lifting machinery.

"Gas Producers for Power Purposes," by W. A. Tookey; published by Percival Marshall Co., 26-29 Poppins Court, Fleet street, London. In this book are explained the advantages, action and application of gas producers to purchas-

ers, erectors and attendants. Gas producers are little known in this country compared with Great Britain, where they have been manufactured and used to a considerable extent. Owing to this fact such a book on gas producers should meet with a large sale in this country. Spon & Chamberlain, 123 Liberty street, New York, are American agents for Percival Marshall & Co.

TWIST DRILLS: THEIR USES AND ABUSES*

(Continued from April)

Split Drills.

A drill split up the web is sure evidence of improper grinding or excessive feed pressure, and no drill manufacturer ought to be expected to replace a split drill unless there is a "flaw" apparent in the break. Almost always caused by such splitting is a failure to grind the correct angle of clearance (see Fig. 15 and section on grinding).

Remedy for Drills Chipping.

The remedy for drills that are properly ground chipping at the cutting edges is to decrease the feed and increase the speed, which, if a little care is taken to arrange properly, will produce as much work as before, with a longer life to the drill. When the extreme outer corners deteriorate too rapidly, it is evidence of too much speed. Therefore the best performance of a drill will be found when the effect of the work on the tool is somewhere between these two conditions.

Speed and Feed.

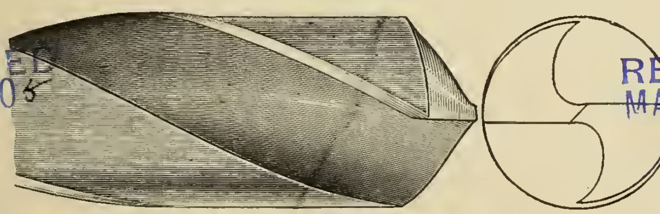
If no table is at hand or operator is in doubt as to correct speed for the drill, start with a periphery speed of 30 ft. per minute for soft tool and machinery steel, 35 ft. for cast iron, 60 ft. for brass, and a feed of from .004 to .007 of an inch per revolution, and then attain maximum results by noting conditions of the drill and following instructions in preceding paragraph.

We have seen 50 point carbon steel drilled with one of our 2-inch drills at a periphery speed of 60 ft. per minute and a feed of .065 inch per revolution, but we do not think that is good practice, as we have found in our own work that the majority of cases are better suited to high speed and light feed carried to the point at which the outside corners commence to wear away.

For automatic machines where holes do not exceed two diameters of the drill in depth, and under a flood of lard oil, high speeds and light feeds are especially recommended. For holes deeper than this it becomes a matter of getting rid of the chips, and a form of point like Fig. 5 is especially efficient, with slower speeds and heavier feeds as the bottom of the hole is approached. Always endeavor in automatic drilling to get a small compact roll to the chip, and if possible keep it intact the entire depth of the hole.

A heavier feed should be used in drilling brass, especially in automatic machines, to insure chips working out, and if lubricated at all it should be flooded.

Fig16.

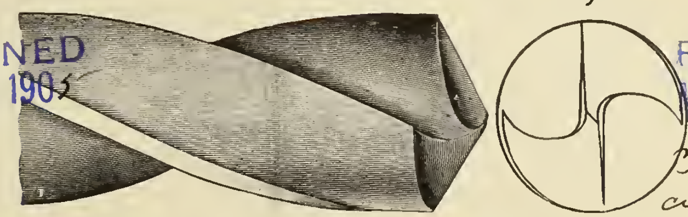


High speeds in cast iron tend to wear away the small portion of the drill that represents the full diameter (see Fig. 1), and 35 ft. per minute peripheral speed should not be exceeded. Feed may be from .007 inch to .015 inch per revolution, according to the kind of metal drilled.

Drilling Hard and Soft Metal.

The drilling of hard material is facilitated by reducing the angle of spiral with the axis, as shown in Fig. 16, so as to permit of heavier feed pressure without chipping the edge, and machines, to insure chips working out, extreme care and judgment is needed to do this without unfitting the drill for further use. This form of drill will also be found efficient in drilling soft material where the regular form has a tendency to "hog in."

Fig17.



Drills Feed Easier.

Drills are made to feed to their work easier by thinning the extreme point. This is a delicate operation and requires some skill on the operator's part, but is a decided improvement in hand-feed drilling. To thin this point properly a round face emery wheel is necessary, and the drill should look like Fig. 17 when finished, care being taken to preserve the true centre of the drill and not weaken the web too much by extending the ground portion too far up the flute.

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* This is published in booklet form by the Cleveland Twist Drill Co., Cleveland, O., and to whom "Canadian Machinery" is indebted for the use of their electros as well as the reading matter. A copy of this booklet—"Twist Drills: Their Uses and Abuses"—will be sent on application to the above firm.

PROGRAMME FOR THE MANUFACTURERS.

Provisional arrangements have been made by the committee of the London Chamber of Commerce for entertaining the Canadian manufacturers during their week's stay in London. On Monday, Mr. S. B. Bolton will probably give a garden party at Totteridge, at which royalty is expected to be present. On Tuesday a visit will be made to the Royal Ordnance Factory at Woolwich. On Wednesday the official banquet will take place at the Hotel Cecil. Thursday is left open. On Friday a special entertainment at the Botanic Gardens by the Industrial Club. On Saturday probably a garden party at Battle Abbey, given by Lord Brassey, with provision made for 250 guests.

ENGINEERING NEWS

AND BUSINESS NOTES

SOCIETY OFFICERS.

Canadian Society of Civil Engineers.

Officers for 1905: President, Ernest Marceau, Montreal; vice-presidents, C. H. Keefer, Ottawa; D. Macpherson, Montreal: and G. A. Mountain, Ottawa; treasurer, H. Irwin; secretary, C. H. McLeod. Rooms: 877 Dorchester st. Montreal.

Engineers' Club of Toronto.

President, R. F. Tate; first vice-president, F. L. Somerville; second vice-president, T. B. Smith; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms: King street W., Toronto.

Canadian Mining Institute.

President, George R. Smith; Thetford Mines, Quebec; vice-president, Thomas Cantley, New Glasgow, N.S.; secretary, H. Mortimer Land, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Canadian Electrical Association.

President, K. B. Thornton, Montreal; first vice-president, A. A. Wright, Renfrew: second vice-president, R. G. Black, Toronto; secretary-treasurer, C. H. Mortimer, Toronto.

Toronto Branch A.I.E E.

Chairman, T. R. Rosebrough; vice-chairman, H. A. Moore; secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Association of Stationary Engineers.

President, Chas. Moseley, Toronto; secretary, A. M. Wickens, Toronto.

Ontario Association of Stationary Engineers.

President, F. W. Donaldson; registrar, J. G. Bain, 113 Yorkville avenue, Toronto.

Engineering Graduates.

The results of the science examinations at McGill University, Queen's and School of Practical Science, Toronto, have been issued within the past two weeks. The following are the results: McGill, the honor list is: Robert Wm. Boyle, British Association exhibition, British Association medal and prize, prize for summer thesis, honors in A.C. machinery, electrical engineering, hydraulics and thermodynamics. Harry Leo Forbes—British Association medal and prize, Dawson fellowship in mining, first Carlyle prize, honors in mining engineering. Thomas Maxwell Fishe—British Association medal and prize, honors in designing, geodesy and theory of structures. Alan Dale Harris—Prize for summer thesis honors in A.C. machinery. John Hogan—Prize for summer thesis. H. Coburn Jewett—Honors in railway engineering. George Kydd—Honors in structural engineering. E. Ibbotson Leonard — British Association medal and prize. Sidney Guy Fleetwood MacDermot—British Association exhibition, honors in electrical engineering. Harry Hind MacMillen—Prize for summer thesis, honors in dynamics of machinery. Clarence Hobart McDougall — Allis-Chalmers scholarship. Charles H. Sutherland—Honors in thermodynamics.

Passed for the Degree of Bachelor of Science (in order of merit). —Engineering: Thomas Maxwell Fishe, Montreal, Que.; George Kydd, Montreal, Que.; F. Coburn Jewett, Sheffield, N.B.; John Hogan, Westmount, Que.; Edward Burton Jost, Guysboro, N.S., Harold William Idsardi, St. Thomas, Ontario; Alfred Allan Putnam, Halifax, N.S.; Samuel Wilfred Hamilton, Montreal, Que.

Electrical Engineering: Robert Wm. Boyle, Carbonear, Newfoundland; Sidney Guy Fleetwood MacDermot, Ropley, Jamaica, W.I.; Alan Dale Harris, Ottawa, Ontario; Wm. Charles McDonald Cropper, Kingstown, St. Vincent, W.I.; Lockwood Burpee, Gibson, N.B.; Delmer Clinton Findlay, Danville, Que.; Haxen Ashley Wheaton, Elgin, Albert Co., N.B.; George Albert Johnstone, Rednersville, Ontario; Hiram Herman Archibald, Harbour Grace, Newfoundland; Charles Willard, Morrisburg, Ont.; Gordon Bond Glassco, Hamilton, Ont.; Gavin Theodore Scouler, New Westminster, B.C.; John Alexander Campbell, Cheltenham, Ont.; Walter Garfield Ross, Port Perry, Ont.; William Redpath, Montreal, Que.; Stanton Herbert Stanley Cunha, Kingston, Jamaica, W.I.; Ernest Wm. Bowness, Kensington, P.E.I.; Kenneth E. Drinkwater, Montreal, Que.; Charles Francis Bedwell, Columbus, Ohio, U.S.; Herbert Lawrence Price, Montmorency, Que.; Clifton Hazle Wright, Barbadoes, W.I.; Donald McLean, Campbelltown, N.B.; Abraham Pinto Joseph, Quebec, Que.

Mechanical Engineering: E. Ibbotson Leonard, London, Ont.; Charles H. Sutherland, New Glasgow, N.S.; Henry Hind MacMillen, Alberry Plains, P.E.I.; George Ackland Gillies, Carleton Place, Ont.; Harvey W. Cockshutt, Brantford, Ont.; Harvard Turnbull, Montreal, Que.

Metallurgy: Alfred McLean Hamilton, Westmount, Que.

Mining Engineering: Harry Leo Forbes, Waverley, Halifax Co., N.S.; Clarence Hobart McDougall, South Maitland, Hants Co., N.S.; Edward Newcombe Martin, York, Ont.; George Pearce Sharpe, Agassiz, B.C.

School of Practical Science—Degree of M.E. (mechanical engineer)—E. J. Laschinger. Degree of E.E. (electrical engineer)—W. Hemphill. Degree of B.A.Sc. (bachelor of applied science), candidates arranged in alphabetical order—N. A. Burwash, A. J. Campbell, A. M. Campbell, U. W. Christie, S. R. Crerar, A. E. Davison, W. S. Gibson, W. W. Gray, W. K. Greenwood, G. S. Hanes, E. A. James, P. V. Jermyn, H. J. McAuslan, O. B. McCuaig, G. C. McEwen, C. D. McKay, F. C. Marriott, G. Pace, J. Parke, D. C. Raymond, G. S. Roxburgh, F. N. Rutherford, J. D. Sheply, W. J. Smither, S. E. Thomson, C. J. Townsend, A. V. Trimble B. B. Tucker, W. R. Worthington, W. F. Wright.

Degree of B.A.Sc., with honors—T. F. Code, A. L. Ford, C. F. McGibbon, R. H. Montgomery, H. M. Shipe, D. T. Townsend, E.W. Walker, C. G. Williams, C. R. Young.

Queen's—Bachelors of Science—C. W. Baker, electrical, Kingston; G. C. Bateman, mining, Kingston; D. D. Cairns, mining, Columbia, B.C.; C. T. Cartwright, mining, Kingston; E. A. Collins, mining, Copper Cliff; A. L. Cumming, civil, Cornwall; T. U. Fairlie, civil, Kingston; R. G. Gage, electrical, Riverside, Cal.; J. R. Grant, civil, Chesley; E. W. Henderson, electrical, Almonte; W. A. Johnston, M.A., civil, Athens; O. M. Montgomery, electrical, Lanark; W. L. MacIlquham, electrical, Lanark, J. G. Macphail, civil, Orwell, P.E.I.; H. H. Scott, electrical, Perth, J. Sears, civil, Kingston, D. Sloan, mining, Perth; B. O. Strachan, mining, Kingston; W. C. Way, electrical-mechanical, Brockville.

Mining Engineer—E. T. Corkill, B.Sc., Sydenham.

CANADIAN

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RECIPROCITY IN COAL.

LORD BEACONSFIELD pointed out many years ago that a country's greatness had every dependence on a cheap source of coal, and this has come to be a popular belief throughout the world. Without coal, without manufacture, has been true in the past and still holds, although to a somewhat less extent since the development of electrical transmission. In Ontario, in spite of our water powers, the coal requirements are as yet proportionately as great as in other countries, and any reduction in the cost of this commodity is that much of a boon to manufacturing industries. The duty of 53c. a ton reacts against our manufacturers, and places the centre of coal supply practically one hundred miles further away. If we are to become a great manufacturing country fuel must of necessity be available for this purpose at the lowest possible cost.

As far as the question of a general reciprocity treaty between Canada and the United States is concerned, there is seemingly little desire for such; but at the same time it is mutually agreed that there are lines upon which reciprocal arrangements would be to the advantage of both parties. There is no commodity to which this would refer more than to coal passing between the two countries. The consideration of a treaty for the free interchange of coal would be an advance in the direction of more satisfactory trade relations between the two countries.

It is contended that the duty of 53c. a ton works to the advantage of the Nova Scotia coal mines in securing the Ontario market, but it has been found from experience that Montreal is the furthest western point at which the Canadian maritime coal mines can compete with Pensylvania. One or two shipments of coal were made as far west as Smith's Falls by way of experiment, but it was found that the heavy transportation charges brought the price beyond that of the Amercian product. It is found further that the Montreal market is open for the successful placing of Canadian coal on account of the fact that it is brought direct by ocean freight in large boats—the latest, the James Ross, having a capacity of 6,500 tons—but further west of the head of St. Lawrence ocean traffic, transportation charges increased very rapidly. This is on account of the fact that coal must be transferred to small boats and carried in comparatively small consignments with a rapid increase of cost ratio. The natural market of the Nova Scotia coal mines is the New England States, where a larger per cent. of the output would be absorbed than could be hoped for from Ontario, whose geographical situation is against its using Nova Scotia coal.

The Dominion Coal Co. is placing coal at the pier at Boston for $3.23 per gross ton, while Pennsylvanian coal costs $3.15 delivered at the same place. Remove the duty on the Canadian article and the New England market is opened up at once to Canadian coal.

In Ontario manufacturers pay about $2,000,000 annually in coal duties, and to what purpose? Supposedly to protect our coal mining industry, which it does not do. They are thus handicapped in the cost of output, with this additional expense to manufacture, which it seems logical and fair to contend should not be.

Reciprocity in coal would do away with this burden, would place the Ontario manufacturer in a better position, would give the New England manufacturer cheaper fuel and would enable the Canadian coal mines not only to hold their present market in Quebec and the Maritime Provinces, but also to secure another many times larger than they have at present.

CANADA'S GROWING TIME.

FROM all parts of Canada reports of building operations on a large scale are being received—big hotels, manufacturing establishments, business blocks, all being included in the lists of permits issued.

In Toronto building permits issued by the city architect for the four months, January to April, represent an expenditure of $2,084,914 in new houses, warerooms and factories. In April the amount was $896,196 for 365 buildings, compared with $492,432 for 236 buildings in April, 1904. During the first ten days in May permits were issued for buildings valued at upwards of $400,000, this including 90 dwellings, costing approximately $250,000, and two large warehouses, one for the Massey Harris Co., to cost $125,000, and one for Brereton & Manning, to cost $25,000.

In Winnipeg so far this year 730 building permits have been issued, covering 980 buildings, to cost $6,010,800, compared with 520, aggregating $2,403,350 last year.

In Montreal similar activity exists, as during the month of April 158 permits were issued for buildings, valued at $658,001, as compared with 111 permits,

representing an outlay of $438,243, for April, 1904. Ninety-one permits were also issued for alterations, valued at $98,347, as compared with 84 permits, representing a value of $67,595, for 1904. The first week in May also shows permits issued for about $180,000 worth of new structures.

Vancouver also makes a good showing, $180,000 being the value of the permits issued in April, about $100,000 of this being for dwellings valued at $3,000 or under, and indicating that there is a big demand for houses.

Statistics cannot be secured from all the towns and cities, but enough has been written to show that the growth is substantial, as in every city the growing population find it difficult to secure roofs to cover their heads. This is Canada's growing time, and while land-speculating booms may over-reach themselves in Fort William, Port Arthur, or Winnipeg, there is little possibility of more houses being built than there are people to fill them. Canada will see a wonderful development during the next quarter of a century in both the older industrial districts and the newer sections to be opened up by the new railway systems.

All this is an index to greater things. The increase in population means larger consumption of manufactured articles. It is an index as well to an industrial expansion, and is only a part of a broader development that Canada is bound to see within the next few years. Villages are becoming towns in a short time, and many places where forest or prairie exist at present, a few years hence will find active commercial and manufacturing centres.

A RECOMMENDATION.

WHEN delivering an address recently on the subject of supplying vacancies for high-grade positions, the head of one of the largest employment agencies in the United States said : "The best testimonial I ever saw contained exactly fifteen words. It read : 'Worked for us four years at $50 a week; wish we could have him back.' " A letter of this kind is brief and to the point, showing the spirit of the company and the capacity of the employe, at the same time containing enough information for the intending employer. If some such letters were given to competent men, and none at all to those who proved faithless to their trust, or heedless of their duty as workmen, it would probably be to the advantage of all concerned. A faithful and first-class man, be he mechanic or otherwise, who wishes to change his otherwise, who wishes to change his position, would thus get the best kind of recommendation, and the one without such a letter would in all likelihood see that he was worthy of it from the next firm with whom he was engaged.

UNIFORMITY IN CATALOGUES.

A CRYING demand exists to-day for a uniformity in the sizes of catalogues and booklets, yet often the very men who realize the necessity are the most culpable when the matter of bringing out their own catalogue is before them. To keep a presentable file of the heterogeneous mass of the literature issued by the various manufacturers—sometimes of the most valuable kind—is beyond the range of possibility. Anyone receiving a number of catalogues cannot fail to have this borne upon him, and with the additional thought that every firm must take a peculiar delight or make a special aim to have their catalogues of a size different to any other. A concerted effort on the part of manufacturers would meet with general approval and it is hoped that before long such a reform will be effected.

The standard sizes approved by some of the most prominent engineering societies in America are 3½x6 ins., 6x9 ins., and 9x12 ins., which gives ample range for any line of output. Not a few of the larger manufacturers have taken this matter in hand in using one or other of these sizes, and more are bound to follow their example. Those in pamphlet form, suitable for insertion in cloth binders, meet with popular favor, and who can tell the influence on the mind of the prospective buyer in carrying out this idea. It costs little, if any, more, to adopt a uniform system and the satisfaction to the recipient is increased an hundred fold. When the millennium is reached in this respect the manufacturer, the engineer and the artist may collect an industrial library in which we can take a pride, instead of as at present being forced to place his catalogues in some hidden corner that none may note the unkempt appearance begotten by a multiplicity of shapes and sizes.

ADVENT OF GAS PRODUCERS.

LITTLE is known, generally speaking, of gas producers on this side of the Atlantic as far as actual experience goes, since their use has been extremely limited. The reason for this is probably due to the fact that just at the time when the gas engine was finding favor in Europe the electric motor was being exploited and largely adopted for power purposes in America. The thought and mind of the manufacturers and. engineers in Great Britain and Europe were turned to the question of the adoption of the gas engine for small power purposes when the electric motor was coming into general use in this country. Greater advances had been made in the design and operation of the gas engine as a prime mover in Europe and consequently more confidence by manufacturers towards its adoption, this being borne out by actual practice and experience. The advances that were being made at this time by American electrical engineers turned the attention of the manufacturing public towards electricity for power, and this, while not altogether, yet to a very great extent, mitigated against the introduction of the gas engine. Lately, however, much more attention has been paid to the merits and economy of this latter prime mover in which connection the gas producer will play an important part.

The producer used combines both simplicity and economy. While with the steam engine and boiler units the thermal efficiency is probably not more than 10 per cent. in actual practice, it has been found that the gas producer and gas engine units have a working efficiency of over 30 per cent. Another point in favor of the gas producer is its economy of operation, it being possible to utilize any fuel whatever for the manufacture of this gas from the leather edgings of boot and shoe factories to the best anthracite coal. In some cities in Canada where electric power is ex-

pensive, some of these producers have been installed, and the results so far have been satisfactory. With such a lead in economy as is claimed for this form of installation there is every reason to believe that when such facts become generally known, gas producers will be adopted to a considerably wider extent.

YOUNG MEN REMAINING IN CANADA.

HERETOFORE when the Spring exodus of engineering graduates from our Canadian universities was at hand it meant, with the large majority, their leaving Canada and taking up positions in the United States. In this way we were losing the greater part of a stock that, remaining, would be a dominant factor in building up the nation, particularly in a country in which the engineering possibilities were as ample and varied as in this. Seeing no immediate prospects here, and being offered inducements by our southern neighbors, the young engineer, following the line of least resistance, accepted what was offered, thinking, perhaps, to return some day, but in nine cases out of ten ultimately becoming a part of the republic. This is equally true of young men in other walks of life as well. Thus Canada has been rearing vigorous, brainy sons, educating them in her public and high schools and colleges after a system unsurpassed by any in the world, while Uncle Sam, keen and astute, has reached out and reaped the benefit. This is well shown in the number of high-class positions now occupied by Canadians in his domain. The cause of this lay not only in the fact that there were openings there for young men of this country such as could not be hoped for here, but also that the true worth and hardihood of the Canadian young man was fully appreciated, while at home such was not the case. It was the same old story of the prophet being not without honor save in his own country.

A change has been taking place slowly but effectively, and more noticeable this year than heretofore, with new-fledged engineers, at least, in which the young man is not seeking scope for his energy and ambition elsewhere but finding and realizing prospects before unavailable. He is beginning to feel that in this country his chances are better, his outlook brighter and his ultimate hopes for the greatest success of far greater measure than in other countries. Without feeling the thrill of the patriot when swearing loyalty to his native land, although possibly some few may be thus influenced, he finds the time has come when he can remain at home and take a position at least satisfactory for the present and offering all things for the future.

The engineering graduates just recovering from the shock of recent examinations and brought face to face with the material world have more cause to be thankful than their predecessors. With other years in the majority of instances it was a case of his seeking distant fields for his labors and giving another country the benefit of his training, but this year few will go beyond our own boundaries. So great has been the industrial development both in the mechanical and electrical trades, railroad and other construction, that the demand for mechanical, electrical, civil and mining engineers, has been greater than the supply. The construction of the Grand Trunk Pacific has called for a large force of engineers for various positions and later a permanent corps of divisional engineers will be needed. The prairie division of the G.T.P. requires men at present, many positions being still open. The growth of the country is absorbing the class of young men who formerly left our confines, and this in itself, apart from any feature of expansion and development connected therewith, should be a gratifying feature to Canadians.

CONCRETE CONSTRUCTION.

ONE of the noticeable features of the present-day trend of development is the utilization of cement for all classes and kinds of construction, from small buildings to the largest class of factory structure. A few years ago the uses of concrete were very limited, being generally applied to the building of bridge and other piers and building foundations. Now concrete is going into the superstructure of many classes of buildings under construction throughout the country. At the Canada Car Co. plant, Montreal, where one of the largest railway appliance manufacturing establishments is under construction, the foundations and walls are being built entirely of concrete.

It was prophesied that concrete work could not be carried on during the extreme weather of our Canadian Winters, but, that this is erroneous, has been demonstrated within the last few months at these works. During the Fall the work was undertaken and before frost set in the concrete foundations were laid. In order to push work as rapidly as possible and to commence manufacture as soon as the buildings could be erected, it was desirable to have the power house completed and installed while the other buildings were nearing completion. Consequently work was commenced on the power house after the approach of cold weather. Everyone remembers the severity of the past season, both as regards low temperature and excessive snowfall in the Montreal district; yet the work of building the concrete walls was carried on with the temperature as low as 10 degrees below zero. The power house is now completed, the walls being finished, roof laid and the installation under way. With the advent of Spring the opinion was freely expressed that the concrete walls built under such conditions would not stand, that they would either crack or bulge or give way altogether; but, notwithstanding that, the structure is perfect and stands to-day without a flaw or crack.

This was not accomplished without the greatest difficulty under the trying existing conditions. All water used had to be heated; the gravel was heated before being mixed and when the mixture was in position between the wooden forms it was necessary to cover it immediately with burlap and other material. It was found that if given a chance to set for forty-eight hours before freezing that any amount of frost after that had no effect whatever. This will probably be gratifying to cement manufacturers and contractors as it was heretofore believed that such work could not be carried on in a Canadian Winter.

The method employed for building the walls consisted in building a wooden framework as a form of 2-inch planed lumber. After setting, this was taken away and the wall rubbed down, leaving a smooth finish. The walls of the entire establishment of the Canada Car Co. will be of concrete, this being the first factory construction of that kind in Canada.

Practical Questions and Answers

Economy of Producer Gas.

Ques. What is producer gas, and how is it made from coal? and on what grounds is it claimed that there is an advantage in first producing this gas and then using the gas as a fuel, over using the coal direct as fuel?

Ans. Producer gas is a mixture of carbon monoxide (CO), nitrogen (N) and carbon dioxide (CO_2). Of these the nitrogen and carbon dioxide are inert gases; that is, they have no heating properties since they will not combine with the oxygen of the air. This gas is produced by the burning of coal, or other fuel, in a limited quantity of air, the object being to convert the carbon of the fuel into carbon monoxide (CO), taking the oxygen from the air. However, it is impossible to prevent some of the carbon monoxide being converted into carbon dioxide (CO_2). Since the air is a mixture of oxygen and nitrogen, nitrogen is mixed with the gas. In these gases nitrogen is present to the extent of from 56 to 60 per cent.; hydrogen, which is not an inert gas but unites with the oxygen of the air to form water (H_2O), also is present sometimes in quantities up to 17 per cent. The amount of carbon dioxide depends upon the efficiency of the gas producer.

One pound of carbon (C) burned to CO gives up 4,480 B.T.U. (British thermal units) of heat, while 1 lb. of carbon burned to CO_2 gives up 14,646 B.T.U. Thus in burning the carbon of the fuel into CO before using for heating or power purposes, 4,480 B.T.U. are lost for every pound of carbon. From this it would appear better policy to use the solid fuel directly instead of converting it into producer gas. However, such is not the case for the reason that with the gas much higher temperature can be obtained, and a large portion of the heat, which in direct systems of heating passes up the chimney to produce a draft, can be recovered. If there be any hydrogen present in the gas when burning it will be converted into water (H_2O) and 62,100 B.T.U. will be given up for every pound of hydrogen present. Thus the heat from the combustion of producer gas results from the conversion of the CO into CO_2 and the conversion of the H into H_2O.

The presence of the inert gases is a disadvantage in that part of the heat of combustion is used to raise their temperature to that of the resulting CO_2; part of the heat is also used to convert the water formed into steam and raise its temperature to the common level.

In actual practice the various methods of producing these two gases differ in detail, but the general practice consists of filling the sheet metal producers with burning coal, or other fuel, to a depth of 8 feet, and drawing air through this bed of fuel by means of exhaust fans. Thus the producer gas is formed, and is sent on to the scrubber or purifier, and from thence to the gas holder. For water gas a boiler is needed to produce the steam, which is led up through the bed of incandescent fuel and is decomposed; the gas is then sent to the scrubber and on to the gas holder. When a mixture of the gases is wanted, they are made alternately in the same producer and are sent to the same holder.

* * *

Individual Drive vs. Group.

Ques. What are the considerations to be taken into account when deciding whether individual drive for an ordinary sized repair and job machine shop would be more or less suitable than group drive by shafting from one motor?

Ans. The consideration must involve cost and efficiency. Let us first consider cost. Under this head would come the first cost of the installation, and also the relative costs of operating under the two systems. The relation between the first cost and the difference in the operating expenses can be computed fairly accurately, and will be a deciding factor in the choice of the two systems. The relative efficiencies of the two systems to perform the work required cannot be computed in figures very readily, but for all that should be given careful consideration.

In order to reckon with definite quantities to some extent let us consider a machine shop containing 9 machine tools, consisting of 3 lathes, 1 planer, 2 drills, 1 shaper, 1 miller and 1 boring mill, besides a hack saw, emery wheel, etc., which might be regarded as taking power equal to 1 machine tool. Now let us suppose that the average power used by each machine, when engaged on ordinary work, is 1 horse-power. Then 10 horse-power would be the amount taken by the machines. From tests made it has been found that the per cent. of power required to run shafting varies from about 14 per cent. to 80 per cent. of the total load. Probably for machine shops from 30 to 40 per cent. would be an average figure, and here calculations will be made on the basis of 30 per cent. Then 70 per cent. of total load is delivered to the machines. Thus in our assumed case $\frac{100}{70} \times \frac{10}{1} = 14\frac{2}{7}$ horse power is the full load on the motor when all the machines are running. Although it is very seldom that all the tools would be running at the same time, the motor should have a rated horse-power of that amount, so as not to endanger its coils by running under a continuous overload. Then let us allow for probable shop extensions by installing a 16 horse-power motor.

Probably in the average machine shop we shall find that one-half the tools are operating continuously under full load. That is, in this case, 5 horse-power will be delivered by the shafting continuously. However, 30 per cent. of full load, or 4 2-7 horse-power, is required by the shafting. Thus the motor will be supplying 9 2-7 horse-power. Now, the efficiency of a 16 horse-power motor is at best between 85 and 90 per cent.; let us say 88 per cent. When running under a load of 9 2-7 horse-power the efficiency would be decreased to about 86 per cent. Thus the motor would be taking from the mains $\frac{100}{86} \times \frac{65}{7} = 10.8$ horse power.

Now, let us consider the alternative method of having each machine motor driven. As we assumed in the foregoing, considering 5 of the machines are running continuously, and still assuming that the average horse-power of the machines is 1, there will be 5 horse-power used by the machines. The efficiency of a 1 horse-power motor is about 72 per cent., and since the load on each is fairly constant, the efficiency does not vary. Thus the power taken from the mains is $\frac{100}{72} \times \frac{5}{1} = 6.9$ horsepower.

Comparing these figures with those obtained in the first case, we find that there is a saving of $10.8 - 6.9 = 3.9$ horse-power. Considering the requirements of the two cases, there is in the one the 16 horse-power motor and rheostat, together with the shafting and belting necessary for transmission, and in the other there are the 11 small motors with rheostat for each, together with extra wiring.

Now, if the cost of the 3.9 horse-power saved is sufficient to pay interest on the extra amount invested for individual drive equal to the per cent. profit got from the business, the two systems are on an equal footing as far as actual costs go.

However, consideration should be given to the relative value of the systems from the standpoint of convenience in handling and operating the tools, etc. The first cost is not the only factor, and in many cases should not be the most important one.

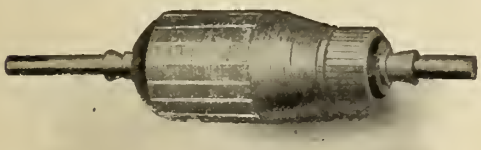
The horse-power is equal to 746 watts or $\frac{1000}{746}$ kilowatts, the system of units in which electrical energy is sold.

Power and Transmission

Steam Gas Electricity Compressed Air Water

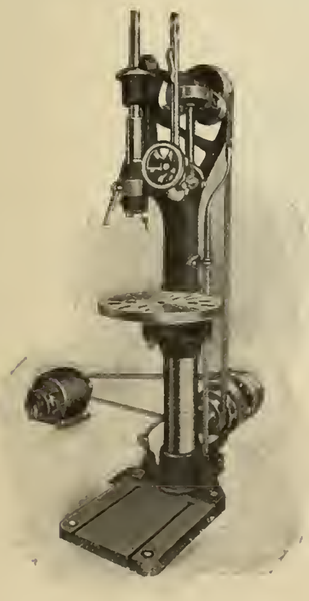
WESTINGHOUSE TYPE R MOTORS.

ALTHOUGH users of machinery in general recognize the principle that high-grade apparatus is essential to successful operation, whether viewed from a commercial or



Armature.

mechanical standpoint, there is often found a tendency to regard almost any construction as good enough for a very small motor. Experience, however, has shown that the general principle applies with equal force to the entire field of electrical construction; that it is never safe to sacrifice quality to price, and that it is always true economy to secure the best, rather than incur the expense of constant repairs and the loss and annoyance caused by defective living apparatus. The motor herewith illustrated, Type R, is manufactured by the Canadian Westinghouse Co., and embodies features of special interest.



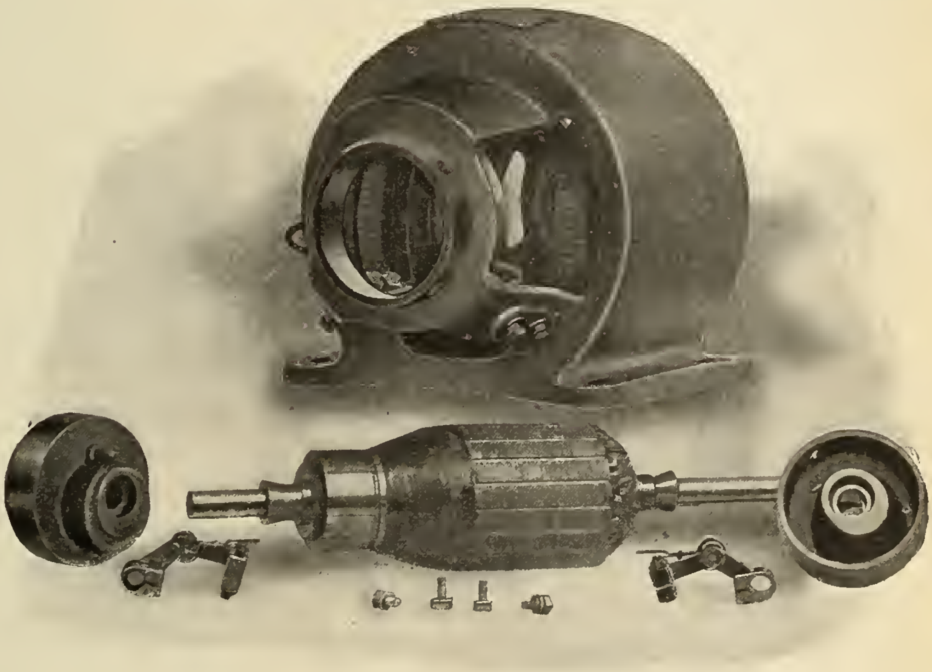
Motor Driving Small Drill Press.

Type R direct-current motors have been produced to meet the demand for thoroughly reliable and highly efficient machines of small power, which shall be easy to install, convenient to operate, require a minimum of attention, and give continuous service throughout a long life. They are constructed in sizes from 1-6 to $1\frac{3}{4}$ h.p., and wound for 110 and 220 volts. The fields are shunt wound.

In appearance these motors are exceedingly handsome, with graceful outlines and a baked enamel finish, which presents a smooth and lustrous surface, pleasing to the eye as well as durable and effective.

Frames.—The yoke, brackets and poles of Type R motors are cast in one piece, a construction which gives a compact machine and provides great rigidity between the support and the driving pulley or pinion. The bore of the bearing housing supports is the same as that of the field poles. Accordingly, the armature can be removed by simply taking out one bearing housing, and this may be done without removing the pinion or pulley, unless it is larger in diameter than the bore of the field poles. The front-end bracket is formed by three arms, which afford protection to the commutator, but leave openings through which ready access to the brushes may be obtained. The two poles project inward in a horizontal plane and are magnetized by machine-formed coils.

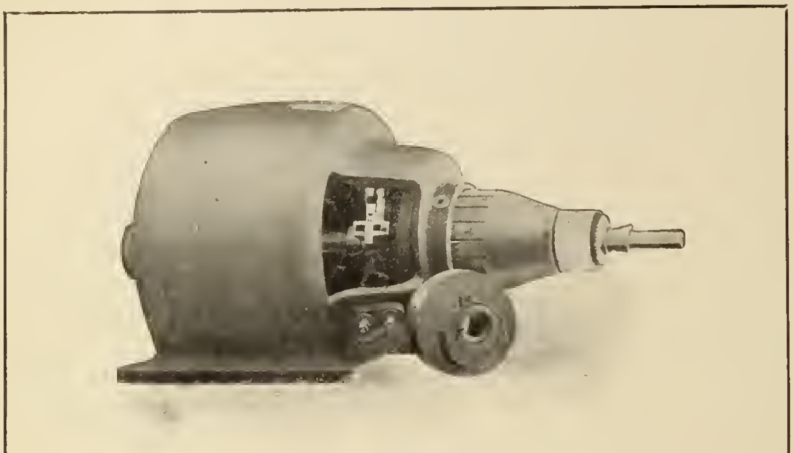
Bearings.—The bearings are of the ring self-oiling type, with linings of phosphor bronze, mounted in separate housings, which may be adjusted in any position, so that the oil reservoirs hang vertical whether the motor be set upon the floor or suspended from the wall or ceiling. The housings are so designed as to entirely prevent the leakage of oil, a defect often noticed in small motors running at high speed. Creeping of oil along the shaft is also prevented by the use of a properly designed oil thrower, or wiper, which protects the commutator and armature. The oil reservoirs are of ample capacity, and the oil rings are easy to inspect, as they may be seen from the opening in the bearing housing.



Type R Motor and Parts.

Armature. — The armatures are of slotted drum type with embedded coils, which are retained in the slots by hard fibre wedges, without band wires of any kind. The great value of this construction has been repeatedly demonstrated in machines of larger capacity. The armature cores are formed of circular punchings of carefully annealed soft steel, treated at our works to secure

high magnetic quality and freedom from aging. Steels not similarly treated rapidly deteriorate with age, and may cause dangerous increase in temperature and some decrease in efficiency. Every precaution is taken to keep down the core loss of these machines, and their operating characteristics remain practically constant during life.



Armature Partly Removed.

Brush Holders.—The brush holders arms are mounted upon rings which are supported at three points inside the motor frame. The individual holders are of the sliding type with the rod construction. Pressure on the brush is exerted by a coiled spring in such a manner as to give the carbon a uniform pressure throughout its width. The carbons are held radial at all times, there being no swivel action during the operating of the machine. A quick-acting spring takes up any vibration that might otherwise occur, and thus insures continual contact between brush and commutator, and obviates jumping or chattering of the brushes.

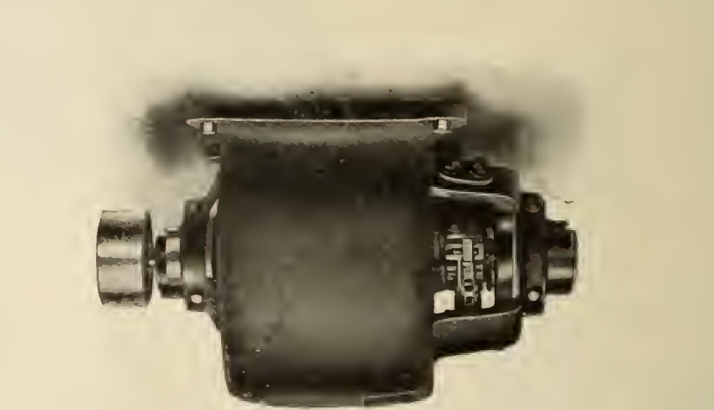
Commutator.—The commutators are built up of hard drawn copper bars assembled upon brass bushes. They are made without necks—a construction which provides a maximum wearing surface and eliminates the possibility of the holders riding against the neck, which exists in the other form.

A NEW STURTEVANT GENERATING SET.

ORIGINALLY built by the Sturtevant Co., of Boston, Mass., for the use of the United States Government, and in accordance with specifications of the Bureau of Equipment, this generating set possesses features of special interest.

The engine is of the high speed reciprocating type, designed to run at 630 revolutions per minute. The cylinder, which is cast with the frame, is $4\frac{1}{2}$ in. diameter and $4\frac{1}{2}$ in. stroke. The valve is of the balanced piston type, and is operated by a Shepherd governor attached to the fly wheel. Quick action and regulation within $1\frac{1}{2}$ per cent. from full load to no load is secured with this governor. The piston is secured to the rod by a taper fit, while the rod itself is held to the cross head by a set nut. The cross head, which is of the slipper type with forked and connecting rod, has a pin $1\frac{1}{4}$ in. diameter by $1\frac{3}{4}$ in. long, while the crank pin is 1 15-16 in. in diameter by 6 in. long.

A neat cast iron frame suitably lagged encloses the entire engine. The



Motor Suspended from Ceiling.

frame is pierced for a large door on front, which provides ready access to the interior, and also serves to confine the oil within the case.

The engine is remarkably silent in its working and is of a type especially desirable for modern yachts and similar service.

The generator is one of the eight pole type, designed for a continuous output of 5 k. w. at 630 r.p.m.

The magnet frame is of the best grade cast iron, to which are attached by through bolts the pole pieces of wrought iron with cast iron shoes. Each pole piece is energized by its own field coils which are easily removable.

The armature is of the iron-clad, two-circuit, form wound, ventilated drum type, having a core of special low steel mounted upon a cast iron spider which has a hub extension for the support of the commutator.

The armature coils are form wound, and are insulated with such material as shall not be perceptibly affected by heat or ordinary atmospheric moisture.

The commutator consists of bars or segments of pure drawn copper, secured in a cast iron shell of spider construction and clamped with a steel ring. The insulation between the segments consists of the best quality selected mica, and the end insulation consists of micanite rings.

The brushes are mounted upon studs which project from a brush rigging attached directly to the magnet frame; this ring being so arranged that it may be rotated for adjusting the position of the brushes.

The brush holders are of the sliding socket shunt type, each brush being supplied with a flexible connection and having a carrying capacity not exceeding 30 amps. per square inch. Each brush and holder may be separately adjusted, and are readily removable for cleaning and repairs.

The generator is capable of carrying for short periods of time, 50 per cent. overload, without shifting of brushes or flashing at commutator, and is capable of continuous operation at 25 per cent. overload without sparking or undue heating.

After a continuous run of ten hours,

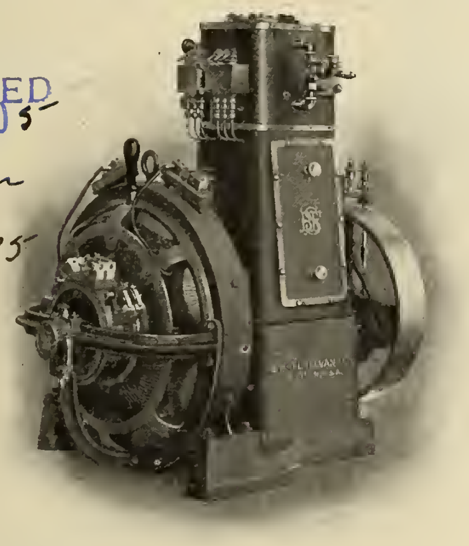
at full load, the increase of temperature above that of the surrounhing atmosphere will not exceed 40 degrees C in any of its parts. The insulation resistance is such that it will withstand a breakdown test of 1,500 volts for a period of one minute and shall show a resistance of at least one megohm with an initial voltage of 500.

The total weight of the set, which includes the engine, generator and sub-base, ready for operation, is 1,140 pounds.

OLDS GASOLINE ENGINES.

TWO of the types of gasoline engines manufactured by the Olds Gasoline Engine Works, Lansing, Mich., are shown in illustrations, the Wizard and Type G.

The "Wizard" engine has a cylinder 4 x 6, and develops two to three horse-



Compact Generating Set.

power, according to the number of revolutions per minute, which vary from 200 to 600. It is governed hy the "hit or miss" principle applied hy a very simple mechanism. When the speed of the engine hecomes faster than required the governor instantly locks the exhaust valve open and also throws the igniter contact out of action. This enables the engine piston to run freely in the cylinder, drawing in and expelling air through the open exhaust passage, while the igniter ceases to make sparks, saving the battery as well as fuel.

The Cylinder.

The principal feature of the cylinder in this engine is that it has a solid cylinder head and, therefore, no gaskets to burn out. The valve chamber is located at the end of the cylinder castings and is not separate from the cylinder, but is an extension of it and is cast in one piece. The burning of gaskets, leakage (causing lack of compression), is prevented and added strength is given to the cylinder head. Every user of a gas engine will appreciate the importance of the fact that there are no packed joints in the cylinder. Ninety-five per cent. of the trouble in operating a gas engine comes from defects in gaskets.

The Water Jacket.

The water jacket is detachable. It is very easy to take off in case it is necessary to do so. The cylinder is firmly bolted to the bed plate by studs. This allows the cylinder to he removed easily, which could not be done if cast solid with the hed plate.

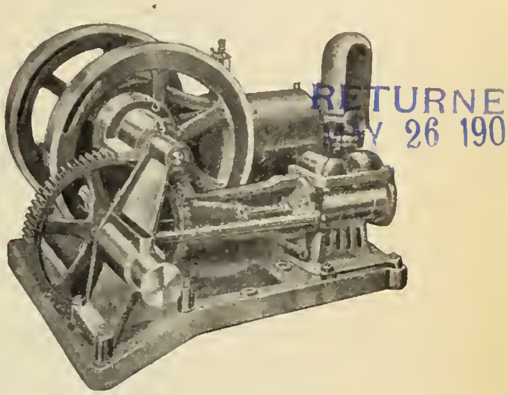
The Inlet Valve.

The inlet valve is easily accessible so it can be readily cleaned when necessary. The valves are of the poppet type, which assures a perfect seat at all times. The air is let into the mixer on all sides at the same time, becomes thoroughly mixed with the gas and produces a perfect combustion.

The exhaust valve is opened hy means of a swinging lever which bears against a flange on the outer end of the valve stem and which carries on its other end a roller running on the lay-shaft cam. There is no multiplication of levers to operate the exhaust valve; only one straight rocker arm operated by means of a set of gears.

The Piston.

The piston is fitted with grooves for the distribution of oil over its entire wearing surface. It is as long as the stroke with the wrist pin in the centre instead of at the end, thus preventing it from being worn tapering. It has two ground snap rings held in place by pins.



Type A or Wizard Engine.

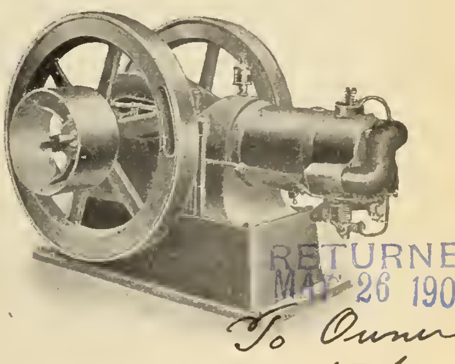
The Governor.

The governor is of the fly wheel type, most simple in its construction, and has the fewest number of moving parts of any governor made. The speed of the engine can he changed hy adjusting the governor with a range of 200 to 600 revolutions per minute.

The Spark Plug.

The method of ignition in the Wizard engine is entirely different than commonly used hy other stationary gas engines. It has the jump spark system of ignition, the same that is used in the Olds mobile, and has proven to he the most satisfactory of any method in use. This method is universally used by most of the gasoline automobile manufacturers and has been subjected to the most severe tests that can he given, and has proven to be the best method of ignition in gas engines of this class. It does away with complicated levers, shafts and springs, which make up the ordinary mechanical igniter used in 85 per cent. of the ordinary engines.

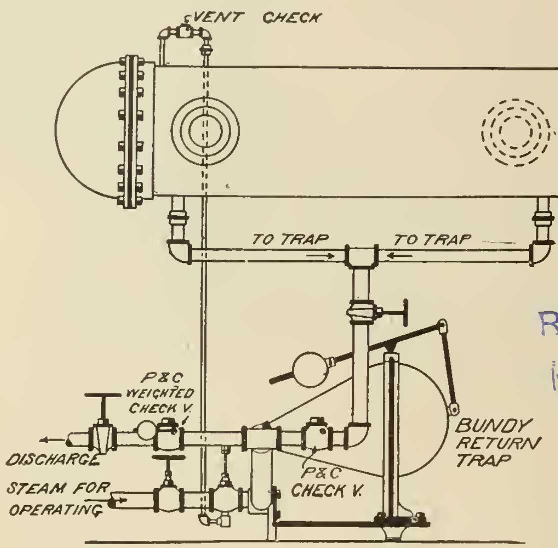
To operate the spark plug is used a



Type G Engine.

battery of six dry cells in connection with the spark coil, the same that is used on the Olds mobile. The spark is caused at proper intervals by contact of the exhaust valve lever with the com-

mutator. The timing of the spark can be regulated by a screw adjustment. They furnish porcelain spark plugs of standard make which are practically soot-proof, as the base of the plug is automatically cleaned by the force of the gas at each explosion.



Trap on Vacuum Work.

The Battery.

The battery consists of six dry cells and an induction coil. The primary current is generated in the cells and passes through the induction coil, producing an induced current of very high voltage, which makes the spark in the plug. The discharge of this induced current is regulated by the vibrator and produces a succession of strong sparks in the cylinder when ignition is desired, instead of one spark as is made by the usual method of ignition through contact points. The necessary connections are clearly shown in the diagram. Wire No. 1 is connected with the spark plug. Wire No. 2 is a ground wire which can be connected to any point on the engine, the screw holding the mixer being as convenient as any, as shown on the diagram. Wire No. 3 is connected to the commutator block which makes the contact with the rocker arm at the moment the spark is required.

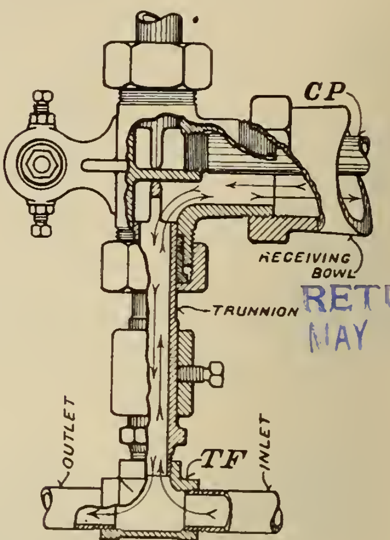
BUNDY STEAM TRAPS.

BUNDY STEAM TRAPS, views of which are shown, are designed to automatically feed boilers, to return condensation to boilers to relieve steam main, and to increase the work producing value of steam machinery. The action of these traps, as manufactured by A. A. Griffins Iron Co., Jersey City, N.J., is of interest.

When the trap is connected in position for operation, communication between it and the boiler is cut off by a steam valve which is a part of the trap, and a check valve, the latter being held tightly closed by reason of the pressure on the boiler forcing a column of water up through pipe leading thereto. When the bowl has filled with water their combined weight overbalances the ball on the lever, causing the bowl to drop to a discharging position and open the valve leading to the boiler.

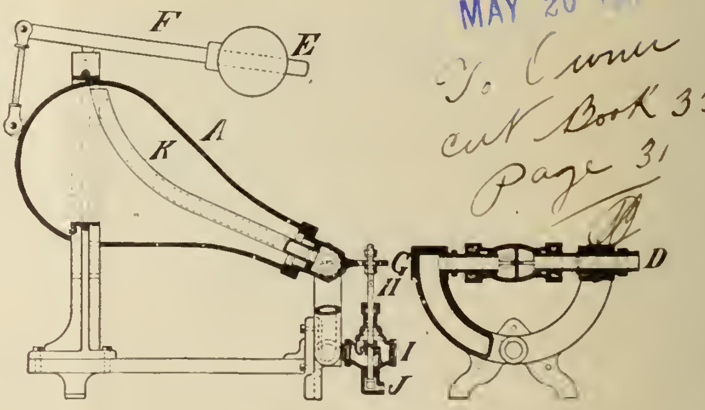
Live steam from the boiler is admitted to the trap. The trap is located three feet above the water line, and as the pressure on both is now equal, with the body of water in the trap at a higher level than the body of water in the boiler, the law of gravity will cause that on the higher level to pass down to that on the lower level.

The return trap, 100 series, consists of a cast iron receiving bowl (A) supported on a yoke and frame by two trunnions, with freedom to move up and down as it fills and discharges. The water enters the feed trunnion (D), shown in the sectional view of the yoke,



Tee Fitting.

passes into the bowl, which when full overbalances the ball (E) on the horizontal lever (F). Thus released, it drops, and the projecting ring (G) pulls up on the valve stem (H) opening the valve (I) and admitting steam from the boiler. The pressure on trap and boiler, now being equal, and the trap located three feet or more above the water line, the water in consequence of seeking a lower level passes from the trap into the boiler. When the trap bowl is empty the weight on the lever pulls it back into its original or filling position, and closes the steam valve. At



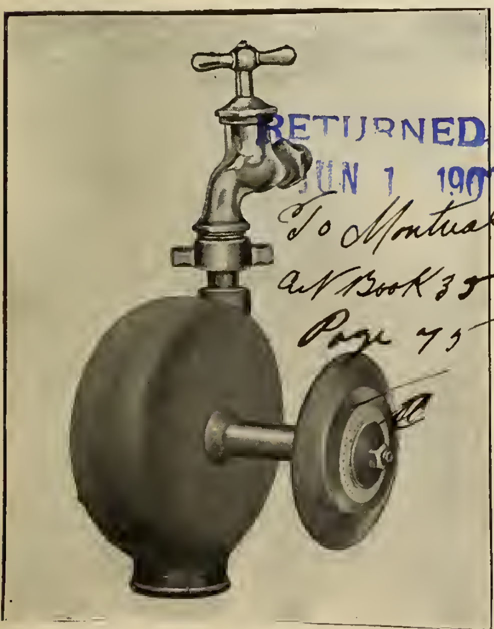
100 Series Return Trap.

the same time it opens the air valve (J) and exhausts the steam remaining in the bowl, as well as air. The steam to enter the trap passes through the interior curved pipe (K) and is discharged on the surface of the water. The trunnion stuffing boxes are equipped with brass followers, which compress the packing against the trunnion neck (G) shown sectionally in the small view, thus preventing any and all binding effects, and giving the trap a free and unimpeded motion at all bearing points.

In the cut herewith presented is shown the general method of connecting a return trap for taking the drips from a heater under vacuum. A close-fitting weighted check valve, set to open outwards from the trap, is used in the discharge pipe to prevent any intake of air while the trap is filling. When discharging, the "P and C" check is held tightly closed by the steam pressure. Connection is made from the vent underneath the steam valve, back to the heater, in order to obtain the same degree of vacuum throughout. The system is simple, easily installed, and a sure means for effecting the desired results.

DIVINE WATER MOTOR.

HEREWITH is illustrated a new and very useful article offered by the Smith & Hemenway Co., of 296 Broadway, New York. It is a water motor which actually develops $\frac{1}{8}$ break horse-power on 80 pounds pressure from



RETURNED JUN 1 190
To Montreal
Cut Book 35
Page 75

Water Motor.

a city main, using No. 150 nozzle, or about $\frac{1}{8}$ in. stream—80 pounds being the ordinary pressure from a city main. Motors are furnished this way unless specially ordered. However, we are informed that they can supply larger nozzles where the power is greater.

The little motor develops a speed, on pressure mentioned above, of forty-five hundred (4,500) revolutions per minute, with an ordinary 5-in. emery wheel or a 9-in. buffing wheel (for polishing). The emery wheel is suitable for grinding knives, scissors, razors, axes, hatchets, hammers, or, in fact, any edge tool. The buffing wheel is suitable for polishing, cleaning and buffing any metal surface.

This will be found a valuable addition to any boarding house, restaurant, dentist, butcher, or private house where any grinding is to be done. It also has sufficient power for running sewing machines, small lathes, scroll saws, dynamos, etc.

The illustration above shows the motor attached to an ordinary screw sink faucet in a private residence, and can be adjusted to either the right or the left-hand side.

We are informed that the motor is almost indestructible. Being strongly built, will last for years without any repairs, and is so perfectly made that all the parts are interchangeable. Extras can be had at a nominal expense.

The total weight, complete, put up in a box, with polishing wheel or buffing wheel, emery wheel, stick of polish, is $6\frac{1}{2}$ lbs.

Printed matter and prices will be sent on application.

PORTABLE BOILER AND AIR COMPRESSOR.

THERE is a demand in many industries for a portable air-compressing outfit which can easily be carried from one location to another and used for the operation of drills,

RETURNED MAY 26 1905
To Owner
Cut Book 3
Page 32

Portable Boiler and Air Compressor.

chipping and riveting tools, sand blasting and similar purposes. The outfit illustrated herewith has been designed by the Clayton Air Compressor Works, of 114 Liberty street, New York City. It is entirely self-contained, as the boiler, compressed-air receiver, air compressor, and circulating pump for cooling the air-cylinder jackets are all mounted on one truck. For riveting hammers the compressor is proportioned to deliver air at about 100 pounds pressure per square inch, while for sand blasting and stone tools, air is supplied at 70 pounds pressure. The receiver permits the storing of air so that a much larger number of tools may be operated than otherwise, since it is only occasionally that all tools are in operation at the same time. The pressure of the air is maintained by a pressure governor, while the compressor is prohibited from running away, in case of a break on the air line, by a fly-ball speed governor, the two governors being so combined that they operate upon a common throttle valve. The compressor engine exhausts into the stack, thus increasing the draught. The air compressor cylinder walls are jacketed and are supplied with cooling water by a small duplex pump.

ABOUT CATALOGUES

Any Catalogue spoken of on this page will be sent upon request. Kindly mention Canadian Machinery

THE Mesta Machine Co., Pittsburg, have issued their general catalogue, 12x9 ins., containing 127 pages and heavily bound in cloth. The catalogue is a very handsome one, and is descriptive of the works, their Corliss and piston-valve engines and their rolling mill machinery. It is illustrated throughout with full-page illustrations.

India oil stones, manufactured by the Norton Emery Co., Worcester, Mass., are described, illustrated and listed in a neat little booklet.

Two neat little booklets have been issued by the Westinghouse & Electric Mfg. Co., Pittsburg, Pa., descriptive of their fan motors.

In a neat little booklet of 40 pages, the James Smart Mfg. Co., Limited, Brockville, Ont., illustrate and describe in detail the Kelsey warm air generators.

The Bath machine indicator for testing the truth and alignment of machine parts is told about in a small booklet issued by the Norton Emery Wheel Co., Worcester, Mass.

A neat booklet is being distributed by the Ingersoll-Sergeant Drill Co., 26 Cortland street, New York, illustrating their different styles of air compressors with a brief account of the adaptability of each.

The "Hatfield" pump is illustrated and described in a 7x10 inch catalogue, issued by Merryweather & Sons, Limited, 63 Long Acre, London, W.C., Eng. The catalogue treats in detail the several uses of this pump.

The Gisholt Machine Co., Madison, Wisconsin, have issued a very handsome catalogue of their boring mills. The catalogue is 8x10 inches, and the illustrations and typographical work are excellent.

The Canadian Time Recorder Co., Toronto, issue literature giving full information about their Premier Canadian Time Recorder. Every manufacturer and every superintendent of a factory or mill should get it.

Bulletin No. 505, of the Sprague Electric Co., deals with flexible steel-armored hose for steam or compressed air. This hose consists of a rubber hose covered with a tightly fitting flexible steel armor.

Machinists should secure from Baines & Peckover, Toronto, or E. G. Prior & Co., Victoria, literature regarding Morton's "Alpha" high-speed steel, which is made in six tempers, covering every need in the machine shop.

"Wattmeters and How to Read Them" is the title of a neat little booklet issued by the Canadian Westinghouse Co., Limited, Hamilton, containing, besides the matter regarding wattmeters, inserts regarding incandescent lamps.

The Monitor duplex steam pumps are illustrated and described in a booklet issued by the manufacturers. the Snider-Hughes Co., Cleveland, O. The steam end of the pumps is described in detail; the steam pistons are of the double head type.

Catalogue No. 120, of the B. F. Sturtevant Co., Hyde Park, Mass., illustrates and describes their standard and pony economizers. The catalogue is 9x 6 in., and contains 45 pages, and goes quite fully into the construction of the economizers.

The revised edition of "Friction Transmission," published and copyrighted by the Rockwood Mfg. Co., Indianapolis, Ind., is out. The object in issuing the catalogue was to assist engineers, etc., in solving problems in relation to friction gearing.

The Pope Manufacturing Co., Westfield, Mass., have issued a small booklet of testimonials regarding their multiple metal posts, a special department for the manufacture of which was recently equipped at their plant in Westfield, Mass.

"Compressed Facts about Compressed Air" is the title of a booklet issued by the Clayton Air Compressor Works, New York, which contains a resume of the points to be considered in buying an air compressor of medium capacity. The matter is copyrighted.

The above is the title of a booklet issued by the Canada Metal Co., Toronto, giving information about their babbit. As this company is making first-class babbit for all purposes, the booklet should be in the hands of every superintendent who buys babbit metal.

In bulletin L508, the Laidlaw-Dunn-Gordon Co., Cincinnati, Ohio, describe in detail the construction and operation of their new air compressor recently placed on the market. Full-page illustrations and detail specifications are given of each of the six styles of this compressor.

The Weber Gas and Gasoline Engine Co., Kansas City, have issued a catalogue, 11x8 ins., descriptive of their gas and gasoline engines and also their producer gas power plants. Particular attention is paid to their gas producers and the gas engines operated by this producer gas.

Bulletin C201, of the Clayton Air Compressor Works, 114-118 Liberty street, New York, is meant to supplement their last general catalogue, and describes and illustrates the improvements in their machines since the publication of the catalogue. The bulletin is 6x9 ins. and contains 48 pages.

Motor fire apparatus is illustrated and described in the 10x7-inch catalogue issued by Merryweather & Sons, Limited, London, Eng. Illustrations and descriptions are given of their several styles of motor fire engines which they have in different parts of the world.

The Sawyer & Massey Co., Limited, Hamilton, Ont., are sending out a large lithograph illustrating in picturesque style the development of their plant from a small foundry on a country road as it was in 1836, to the large plant now established in Hamilton. This firm manufacture engines and threshing machines.

Catalogue 9, of the Goldie & McCulloch Co., Limited, Galt, Ont., is devoted to wood-working machinery. The catalogue is 6x9 ins., and is bound in cloth. In this catalogue the various wood-working tools manufactured by this firm are illustrated and described in detail. The catalogue exhibits good workmanship.

The April, 1905, bulletin published by Allis-Chalmers-Bullock, Ltd., describing and illustrating the Bullock induction motor type AN, is of the usual size and style published by that firm.

A. L. Ide & Sons, Springfield, Ill., have issued a catalogue 9x6 in., illustrating and describing their Ideal steam engine, which is a simple high-speed piston valve engine.

Wm. W. Nugent & Co., 18-30 W. Randolph street, Chicago, have issued catalogue No. 6, which will supersede all former catalogues. Their various oiling devices are illustrated and described, with price lists. To make the catalogue of extra value a treatise on "How to Oil an Engine," by Wm. Nugent, is printed with the catalogue.

Ammonia condensers are dealt with in a bulletin published by the Atmospheric Condensation Co., Kansas City, Missouri. Other bulletins issued by this firm are descriptive of the saturated air surface condenser for exhaust steam, the economical operation of modern refrigerating plants, the Winkler power and pressure regulator and also atmospheric condensation in general.

The Hess-Bright Mfg. Co., 245-7 North Broad street, Philadelphia, Pa., in two catalogues, describe the Hess-Bright ball bearings, and discuss the importance of eliminating friction to as great an extent as possible in order to transmit power economically by line shafting. One catalogue is devoted to the description of the ball bearings and the other to the consideration of economic transmission of power.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

UNIVERSAL TOOL AND CUTTER GRINDERS.

Universal tool and cutter grinders are particularly adapted for tool-room use. The illustrations show the No. 2 grinder manufactured by the Norton Emery Wheel Co., Worcester, Mass., and some of the classes of work to which it is adapted. They are used for any cylindrical or conical grinding usually done upon centres or in the chuck; for sizing internal work in an accurate manner and sharpening all forms of cutters, reamers, counterbores, taps, countersinks, etc., and for many surface grinding operations.

The bases of these machines are composed of a single casting. The column top has a complete circle on which the swing table turns and to which it can be clamped at any point. The elevating post is fitted at the base with bronze nut for the elevating screw which can be renewed at any time. The cross feed screw is provided with a bronze nut in the swing table which can be renewed at any time. It also has a bearing on the cross feed slide, which is independent of the slide, enabling the machines to be fitted with cross feed screws of either U. S. standard or metric at short notice, these parts being interchangeable. The column tops are graduated in degrees, and the cross feeds in thousandths of an inch. The swivel tables are provided with a dovetail shape, on which the head and foot stocks slide. They are guided from front surface of the table, and as it is bevelled underneath, there is no possibility of emery dust collecting. It also reduces the wear on this surface to a minimum, insuring a better alignment of the head and foot stocks. The swivelling tops of the sliding carriages are provided with screw adjustment for aligning the centres. This adjusting screw is at the left hand end of the table, so that a taper in either direction can be had without taking the screw and post from the sliding swivel table.

A graduated hand wheel on the feed screw is provided so that feeds in thousandths of an inch can be had without any further adjustment than the direct use of the table feed screw. The machines are provided with a straight bearing, hardened and ground steel spindles with taper bronze boxes. The take-up for wear of the spindle is provided for by a shoulder near the right-hand end of the spindle and a rod and screw in the left-hand end of the spindle by which the pulley can be adjusted, thus bringing the wear on the two ends of the right-hand box. The head-stocks are provided with a single binder screw, and by means of a collar and bushing the operator is enabled to bind the sleeve in place, or separate the head-stock sufficiently to allow it to be removed. The foot-stock sleeves are so arranged that a lever below the sleeve enables the operator to take work out of the centres by simply pressing down on the lever, which draws back the tail-stock centre about $\frac{3}{8}$ per cent. maximum. The elevating head is operated by hand wheel and screw, the hand wheel being graduated in thousandths of an inch.

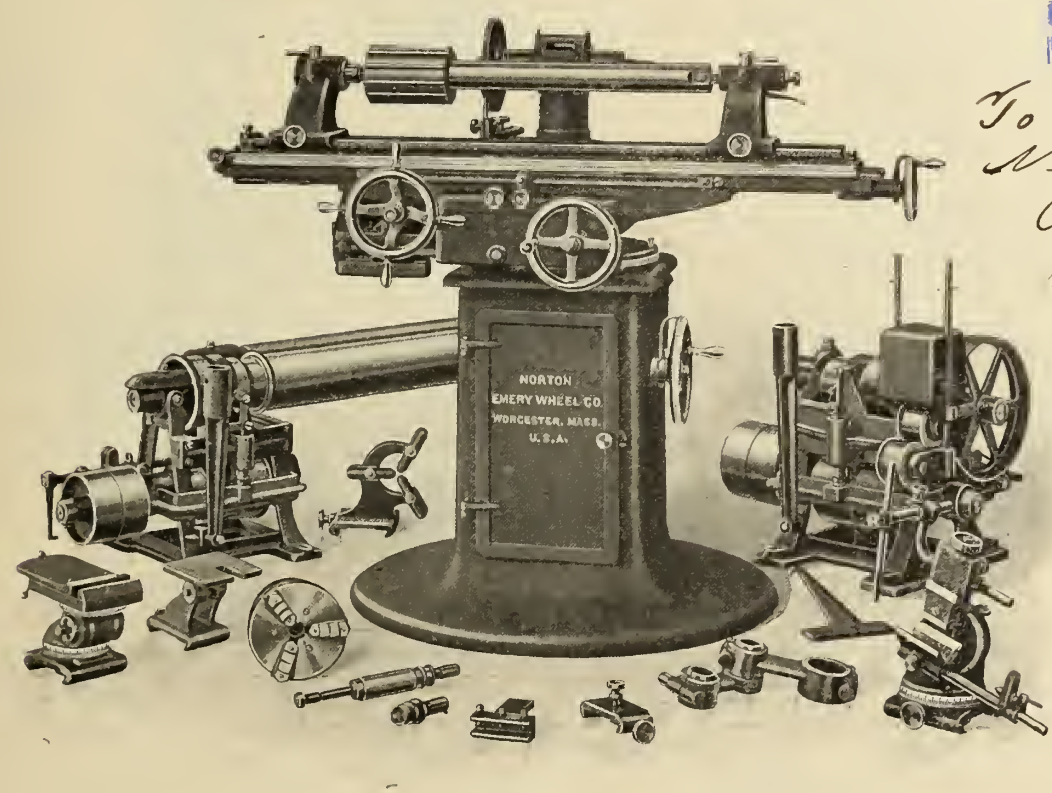


Fig. 1. Norton Universal Tool and Cutter Grinder.

THE NEW PRENTICE RADIAL DRILL.

THE Prentice Brothers Co., of Worcester, Mass., are getting out a line of new gear-driven radial drills which embody a number of new ideas. They will be manufactured in the company's standard seven sizes, from 3-foot swing up. The new machine is shown in the accompanying illustration. Among the features of the new radial is a new clutch, designed principally to secure a reverse on the arm. The clutch consists of two arms, or pins, which spread the friction ring, hugging the inside surface of a cupped-out beveled gear. A beveled spool is fitted closely on the shaft, and is operated longitudinally on the shaft by means of a lever at the front of the head. The spool spreads the friction arms, or pins, which in turn expand the friction ring which clutches the gear. The friction is splined to the shaft and drives the beveled gear. The spool is case hardened and the pins are of hardened tool steel. By means of this clutch the operator is enabled to reverse a tap with the greatest ease, there being none of the customary delay caused by the failure of a clutch to work quickly. This clutch may be thrown in or out while the spindle is running, no matter what the strain on the spindle may be.

The back gears are arranged to be thrown in or out without stopping the spindle, by means of a lever on the head of the machine. The high speed is driven by friction, low speed by means of a positive friction clutch which places the ratio of gearing between the friction clutch and spindle, when the back gears are in, at about ten to one. The back gear ratio is five to one, and there is a constant ratio of about two to one between the friction and the spindle. Thus the friction is aided by that leverage.

By means of the clutch-reversing mechanism, and the device for throwing in and out the back gears instantly, the operator is enabled to save time in tapping. Immediately the bottom of the hole is reached the operator with one hand reverses the motion of the spindle, while with the other hand he disengages the back gear and the tap is backed out at five times the tapping speed.

The automatic stop motion is adjustable for drilling holes to any depth, and is arranged to throw out the feed when the spindle is at its lowest position. This is accomplished by means of a slot in the quill and a vertically-adjustable pin. With a gear-feed radial this feature is very important, preventing the possibility of damage which must result were the drill to keep on feeding beyond the desired position.

The new tool has eight changes of feed, by means of primary and secondary banks of gear, the primary having four changes, and the secondary two. The feeds range from 0.005 in. to 0.054 in. in geometric progression, to one revolution of the spindle.

Another feature is the device for the quick return and approach of the spindle to and from the work. This is accomplished by means of the double handle shown on the front of the head, which is either pulled or pushed to operate a

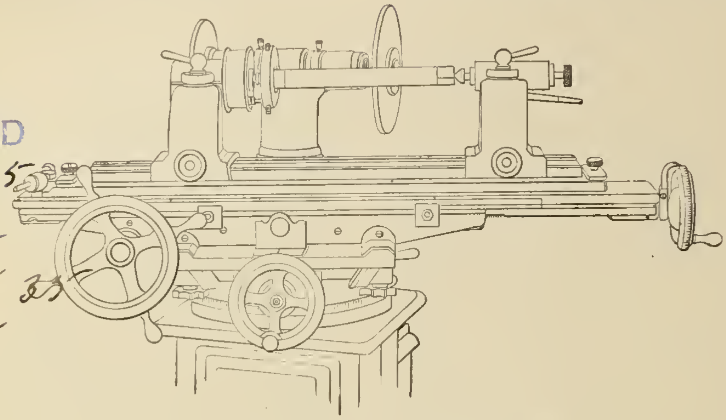


Fig. II. Grinding Work on Dead Centres.

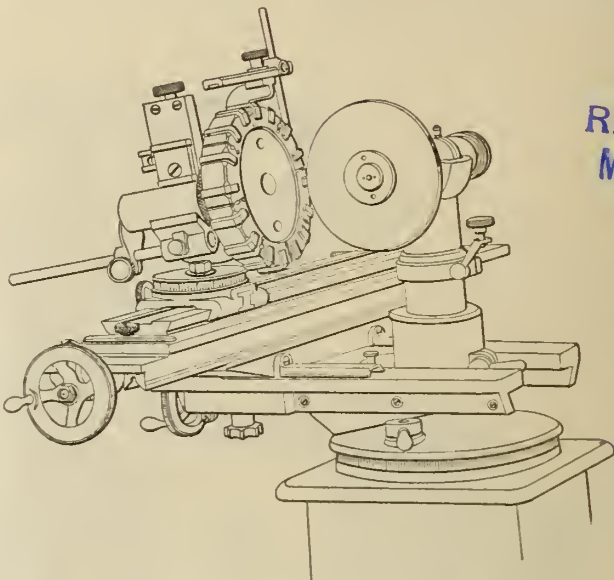


Fig. III. Sharpening Large Face Cutter.

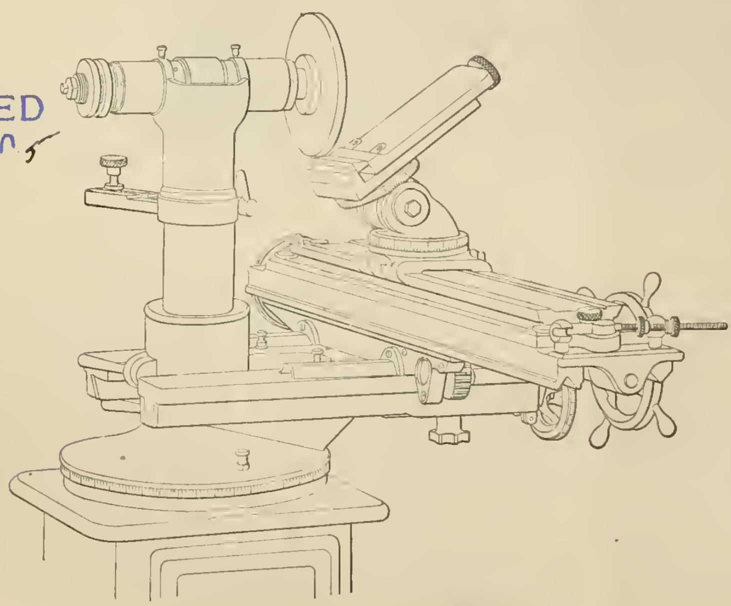


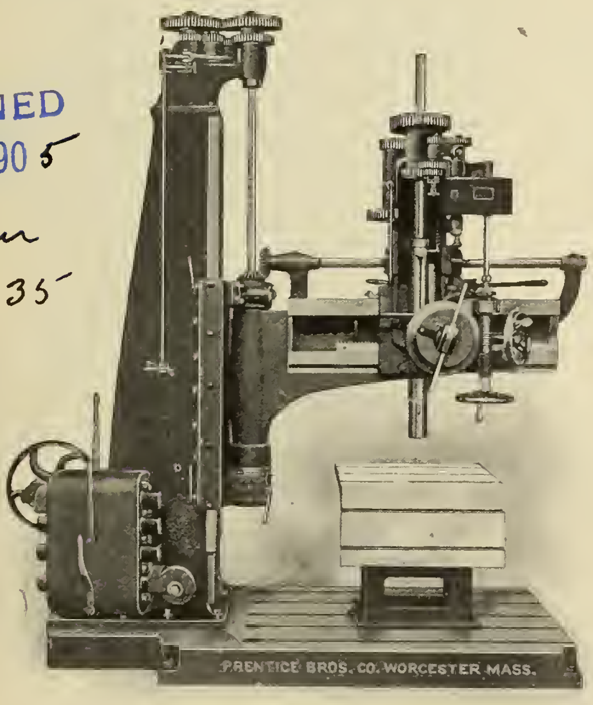
Fig. 4: Showing Use of Universal Vise.

friction and engage the power feed. With this handle the spindle is lowered to the work, and immediately the cutting tool or drill touches the work the power feed may be engaged. Instead of it being necessary to raise the spindle, sometimes as much as ½ inch, in order that the clutch teeth will intermesh to start the power feed, thus compelling the spindle to run idle to the work, the hand feed permits the operator to force or crowd the feed by hand ahead of the power feed. In this way the V-point of a twist drill can be fed by hand faster than the feed to be used when the drill is cutting at its fullest diameter.

The radial is driven by motor or from the main line shaft by a gear-changing device at the base of the column, as shown in the illustration. There are eight changes of speed, by means of four shafts, 11 gears and six friction clutches, which are operated by the three levers shown on the front of the case covering the device. All three levers must be in clutch in order to run the machine, and it is impossible to lock gears in conflicting ratios and, therefore, damage through carelessness is made impossible. A plate showing the different combinations of the levers to give the eight different speeds is attached to the machine. Throwing the three levers to the left gives the fastest speed; throwing the upper lever to the right, the two remaining levers at the left, gives the next fastest, and so on to the slowest, which is accomplished by throwing all levers to the right. By means of the back gears 16 changes of speed are obtained.

The vertical shaft inside the column transmits power from the speed-changing device to a pair of spur gears at the top of the column, and a second vertical shaft on the outside of the column transmits the power to the arm and the arm to the head. The arm is raised and lowered by power without stopping the machine, by means of a lever on the side of the column. The lever throws in a train of gears at the top of the column for raising the arm, and throwing the lever the opposite way throws in a different ratio of gears, which lowers the arm twice as fast as it is raised, which is easily accomplished because of the greater ease with which the arm is lowered compared to power required to raise it. The base-plate is T-slotted and heavily ribbed. The driving pulley is placed at the side of back of the column, as ordered, allowing the machine to be placed at right angles or in line with the main shafting.

The radial shown in the engraving has a 5-foot arm, and will drill to the centre of a 114-inch circle. The traverse of the spindle is 15 inches; traverse of saddle to column 34 inches; distance from spindle to base-plate, maximum 60 inches, minimum 10 inches; diameter of spindle in sleeve $1\frac{7}{8}$ inches; hole in spindle, Morse taper No. 4; speed of the driving pulley 300 r.p.m. The total height of the machine is 106 inches and the weight 6,000 lbs.



New Prentice Radial Drill.

MOTOR-DRIVEN SHAPER.

A NEW application of motor drive is shown in the illustration in article on "Power in Manufacturing" of the 24" part geared crank shaper manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio. In this machine the journal of the main gear has two diameters, i.e., the inner end is twice the diameter of the outer end, overcoming any tendency to break at the junction of the gear, and there is a third or outer bearing to the cone shaft. The crank block is a steel forging, and is set well into the cup of the gear, permitting the rocker arm to travel close to the edge of the gear, thus avoiding the usual overhang. There are full length taper gibs throughout, adjustable endwise by single screws, namely, for the ram, head, rail, apron, and crank wheel slides, affording metal contact on both sides of the gib. This, while expensive to make, is decidedly preferable to gibs with set screws impinging with varying pressures at the several points in the length of the gib. This machine may be used either in single or back geared form, the ratio of gearing being in the one case six revolutions of the cone shaft to one stroke of the ram, and in the other twenty-six to one; the highest ratio of any machine of its stroke made. The cross feed connecting rod is automatically adjustable to any height of the rail, and is not dependant upon frictional contact. An outer support, as shown, is regularly furnished with each machine, without extra charge. This, to be of any practical use, demands two conditions: one a base stiff enough to withstand the thrust put upon it; the other that the surface the support rolls or slides on shall be truly parallel with the travel of the table. These conditions are met with in this shaper.

Ball bearings are provided under the elevating screw to the rail, and the screw, of telescopic form, never receding below the floor, is out of the way of falling chips. The vise is of improved double screw form, has a graduated swiveling base, and permits straight or tapering pieces to be securely clamped with equal facility and with rapidity. Its jaw plates are of annealed tool steel. Key-seating of shafting and of similar work up to four inches in diameter is provided for by an opening through the column under the ram.

Relative to the motor application: The gear wheel immediately below the four-step cone on the machine is attached to the initial, or, in the regular machine, the cone shaft. The pinion on the shaft directly above, carrying in the machine in question, the cone pulley, meshes into this large gear on the initial shaft. The motor in this case is constant speed, hence the use of these cone

pulleys. The small wooden hand wheel on the cone shaft is for adjustment of the ram by hand. The rod immediately below the large gear wheel is for changing the back gears in the machine, and the curved handle at the side of the machine operates a brake on the inside of the cone pulley. The leaf carrying the motor is hinged at its lower end and is adjustable for the purpose of tightening the belt through the cap and set screws shown.

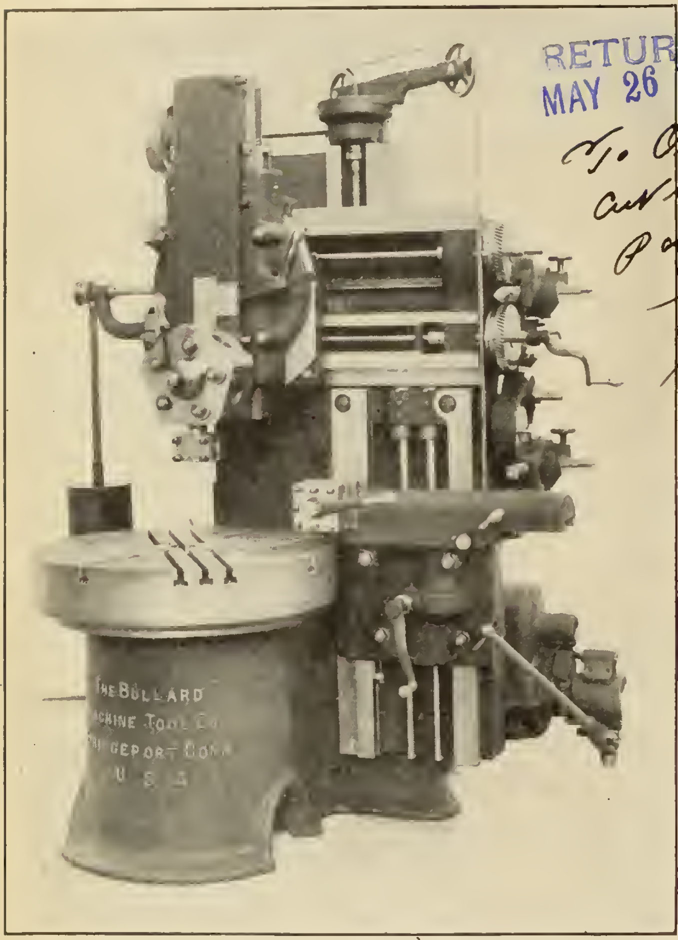


Fig. 1. Front View of Bullard Vertical Turret Lathe.

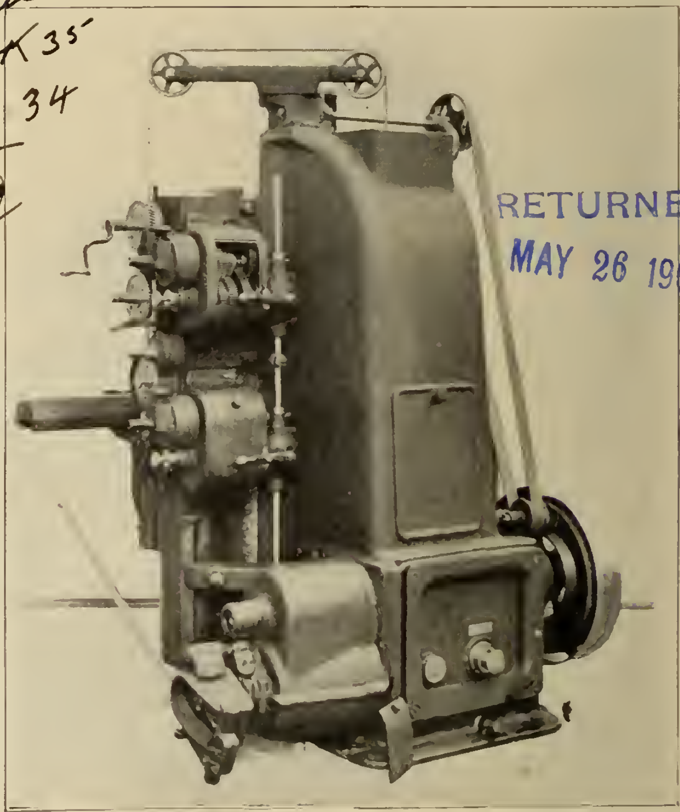


Fig. 2. Rear View, Showing Driving and Feeding Mechanisms.

BULLARD VERTICAL TURRET LATHE.

A NEW product of the Bullard Machine Tool Co., Bridgeport, Conn., is herewith shown in three illustrations, being a rapid production vertical turret lathe of special design. The similarity between this machine and a lathe is strikingly shown in Fig. 3.

The two heads of the machine are entirely independent in their feed movements, and have both vertical and cross feeds.

The vertical head mechanism is the same as in the recent boring mills of the Bullard make. It carries a five-face turret, will face a diameter of 36 inches and has a vertical and angular movement of 26 inches. The cross and side rails are connected together, forming a unit which has a vertical movement by power of 12 inches. The saddles have the narrow guide bearings of the Bullard mills, the ratio of length to width being great, preventing tilting and binding of the heads. One of the most important features of the machine is the possibility of using both of the heads simultaneously without their interfering on work of small diameters. Another advantage is that no long boring bars or extended tool holders need ever be used in the vertical turret, the side head turret being available for operations which would ordinarily require such an equipment. The side head carries a four-face turret and may be swiveled for angular facing to 15 degrees on either side of the horizontal. The head has a vertical movement of 28 inches and a horizontal and angular movement of 15 inches. A threading attachment may be applied to this head if desired without special fitting.

The machine is driven from a constant speed pulley and has 15 possible speed changes, obtained through a cone of gears and a diving key in a gear box at the rear of the machine, on the opposite side from the driving pulley. It is manipulated by a lever at the front within easy reach of the operator, as are also the other controlling levers of the tool, a fact which is well brought out in Fig. 1. The table is 34 inches in diameter and is driven by an internal spur gear of a diameter nearly that of the table. The table speeds range in geometrical progression, the maximum surface speed being 21 feet per minute at 2 inch diameter, and the minimum speed 27 feet per minute at 36 inches diameter.

The following are the advantages claimed for a vertical turret lathe over one of horizontal construction: The handling of heavy face plate work of all descriptions is facilitated, as the vertical construction permits of a very rigid frame or bed; larger spindle sizes and greater power, while the added weight of the work resting directly on the spindle thrust bearing tends to preserve rather than to destroy the alignment. There is also freedom from chattering and vibrating, rendering possible rapid work of good quality which would not be possible in a horizontal machine, on account of its heavy overhanging parts. It is also more easy to set the work in a vertical lathe, and it may be accomplished in a shorter time. In a horizontal turret machine there are usually combined a turret slide having only a longitudinal movement and an ordinary lathe carriage. The latter in many

instances interferes with the proper operation of the turret, making it necessary to use long unsupported boring bars and extended tool holders. The turret having no cross movement is limited in its useful operations, often requiring expensive special tools. Taper boring, except with special equipment, is practically impossible in a horizontal turret lathe, whereas in a vertical machine the swiveling of the vertical head to any angle up to 45 degrees on either side of the vertical and the possibility of cross adjustment makes it easy to perform operations of taper boring and turning.

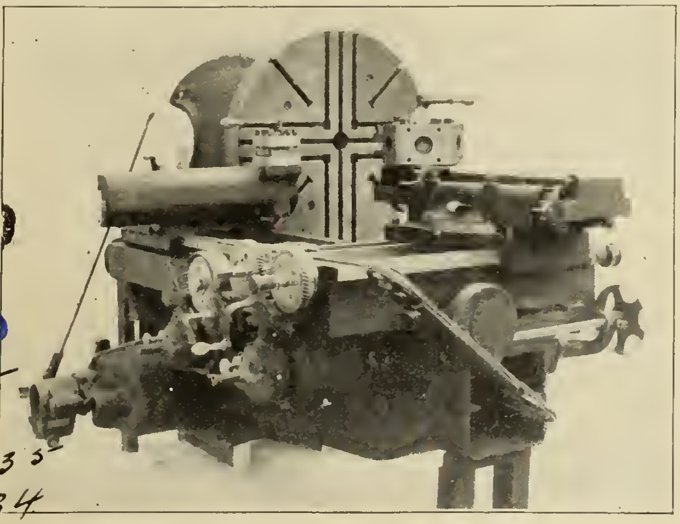


Fig. 3. View Looking Down on Bullard Vertical Lathe.

AMERICAN LATHE WITH MOTOR DRIVE.

IN the 24" x 8' American lathe illustrated in article on "Power in Manufacturing" the main points of interest are the special multiple tool rest for the rapid turning of cone pulleys and the arrangement of motor drive through an all-geared head.

The motor is 9 h.p., of the direct-current, variable speed type (600 to 1,200 r.p.m.), and is easily started, stopped and reversed by the controller handle, conveniently placed at the right end of the carriage. The large number of speeds obtained electrically supplement the fundamental speed changes obtained mechanically through the all-geared head.

The patented all-geared lathe head is a remarkable, new mechanically speed changing device which provides four spindle speeds, the ratios of which are 32.5 to 1, 10.8 to 1, 1.31 to 1, and 1.44 to 1. On account of the high gear ratio and the wide face driving pulley the enormous power of this device is evident, the lathe taking, without evidence of distress, continuous cuts entirely beyond the pulling power of the ordinary lathe of much greater swing. Between 300 and 400 per cent. more work can be turned out on this than on the ordinary lathe.

Each mechanical speed is obtained instantly and easily while the machine is in operation, through the manipulation of the two levers shown on the front of the head, which in turn operate powerful, positive clutches. The construction is extremely simple, powerful and efficient, since only six gears are required in this device. They are coarse pitch, wide face and cut from the solid, and being arranged to run at very low pitch-line velocities, reduce to a minimum the noise incident to all gear drives. They are completely and neatly housed in with means of easy access to all working parts, and with means for thorough lubrication. There are no slip gears, pull pins, hollow shafts with their attendant weakness, no tumbler gears, no complicated, delicate or frail parts.

All shafts and spindles run in the best quality phosphor bronze boxes of liberal dimensions, which are provided with improved and effectual means of lubrication. The necessary adjustment for any desired speed can be determined readily by reference to a simple yet complete index plate on the front of the head.

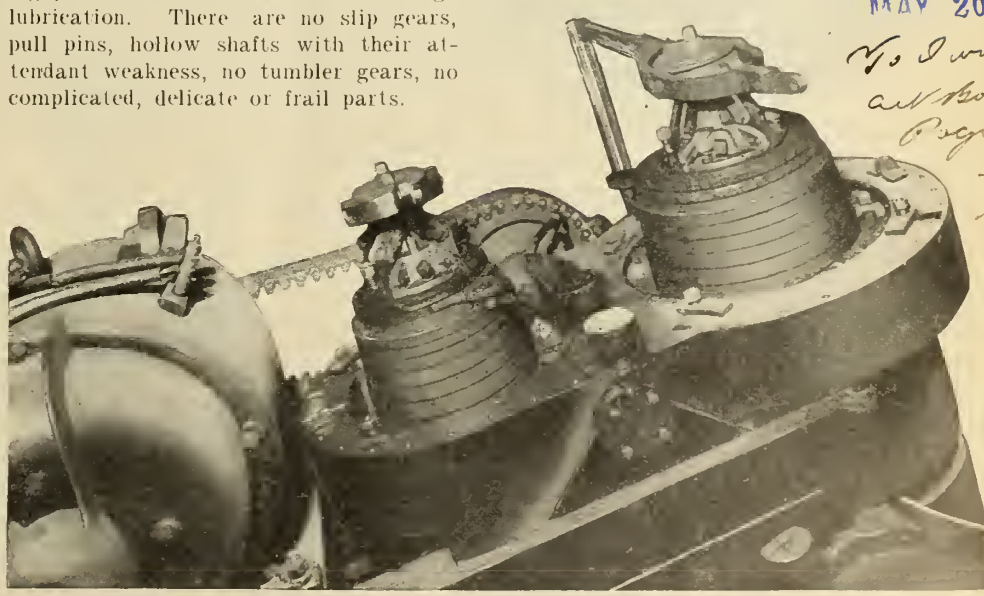
In addition to the all-geared changing device, this lathe is equipped with the rapid change gear mechanism, providing a wide range of changes for feeding and screw cutting, each change instantly and easily obtainable while the machine is in full operation, without removal of a single gear. Simple yet complete index plate shows clearly how to obtain any desired feed.

This lathe, though motor driven, may be arranged for belt drive by simply replacing the gear on the driving shaft with whatever size pulley is desired. As it is unnecessary to shift the belt to change the speed, a pulley of very wide face and large diameter may be used. The regular carriage equipment consists of compound rest and full swing rest.

The lathe is built for the heaviest duty, and will utilize the greatest efficiency of the best high speed tool steels.

DOUBLE FRICTION COIL CLUTCH.

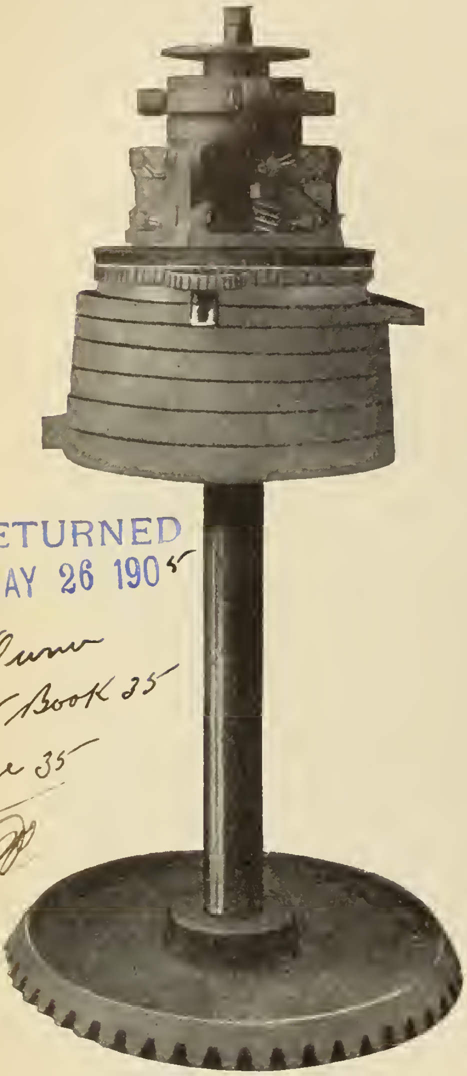
THE clutch shown in two illustrations is a new departure, manufactured by the Double Friction Coil Clutch Co., 12 River street, Chicago, Ill., and combines great strength and power-transmitting capacity. It is made for all kinds of service either for high or low power or high or low speed. It embodies features quite unlike anything that has ever been made before, and there is no possibility where it is used of accidental contact which would endanger the lives of the workmen. It is particularly adapted for hard and rough work where frequent stopping and starting must be made instantaneously. One of its principal features lies in its com-



Clutches as Used on Automatic Loading Machines.

pactness and this results in a large saving of space.

At present the clutch is made in 16 sizes, capable of transmitting from 3 to 600 horse-power at 100 revolutions per minute. The smallest clutch has an outside diameter of $7\frac{1}{4}$ inches, and occupies a length on the shaft of $11\frac{3}{4}$ inches. The largest if $36\frac{5}{8}$ inches in diameter, and takes up a total length on the shaft of about 55 inches. The intermediate sizes increase at about a uniform rate, nicely covering a range of sizes from which a selection may be made to suit almost any case. A feature of the clutch is that it can be adjusted to slip at any desired horse-power without damage, for there is nothing about it to burn out.


250 h p Clutch for High Speed.

The adaptations of the clutch are many. Outside of the straight plain transmission where the driven shaft runs in only one direction or is stationary, there is another common arrangement in which two clutches are combined, and rotation of the driving shaft may be had in either direction or the shaft may be allowed to stand idle, one shifter being sufficient for all three conditions. The clutches work equally well on either horizontal or vertical shafts. Sometimes instead of placing the two clutches on the same shaft they are placed one above the other on separate shafts where it is desirable to have one shaft standing and the other running, and vice versa. In short, the clutch is applicable to any use where the requirement is an ability to connect or disconnect a driven member from a driving member.

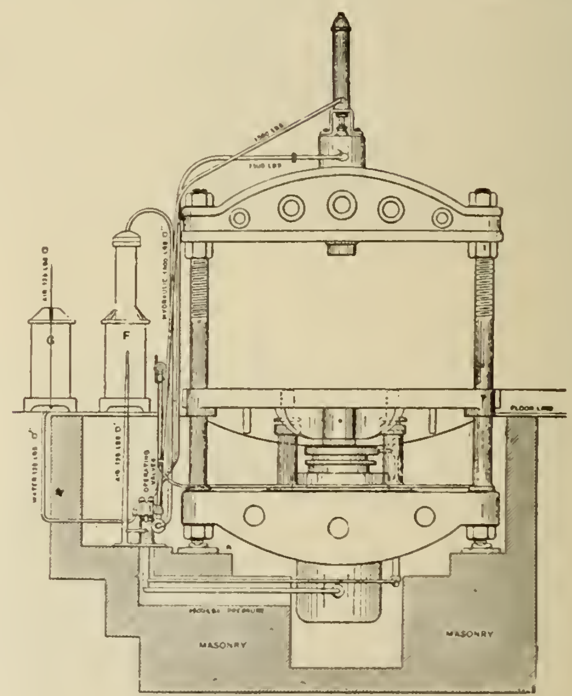
NEW HYDRAULIC SYSTEM.

An hydraulic forging machine is illustrated, showing the system recently introduced by W. H. Wood, of Media, Pa. It has a 550-ton cylinder for operating the platen, a 110-ton internal clamping cylinder, a 160-ton cylinder in the head of the press and four 6-inch auxiliary jack clamping rams. The main plunger on the press has a 48-inch stroke and the plunger in the head has a 36-inch stroke. Hydraulic pressure is applied through the medium of the differential F and the low-pressure reservoir G, which are controlled by hydraulic valves of a form manufactured by the inventor. A striking advantage is that each of the cylinders in the press can be operated by an ordinary three-way cock, instead of costly valves which are ordinarily used for hydraulic machinery when operated from accumulators and pumps.

The same system has been applied to a number of other machines, including the following: An $18\frac{1}{2}$-foot gap riveter with multiple cylinders for putting variable pressure on the rivet from 30 to 150 tons, and a plate closer of 30 tons capacity; a 60-inch punch which will punch 4-inch flue holes through $1\frac{3}{4}$-inch plates, and three other hydraulic punches and a shear of varying capacities. This machinery, it has been found, can be worked without hydraulic pumps or accumulators by a series of differentials, and the operating valves and high-pressure mains for conveying the water which are usually used with accumulators and hydraulic pumps can be dispensed with. It is said that the machine can be operated with just as good results as from an accumulator and pump, and without the shocks which usually attend the older arrangement.

For putting the pressure on the water air pressure at 125 pounds is used, which is now commonly available in any boiler shop or bridge works. The tools previously enumerated can all be operated simultaneously from the compressor, which would deliver, say, 1,000 cubic feet of air per minute. However, as all the machinery would seldom be in operation at one time, only a portion of this quantity of air would be required.

In working the press under this system, as compared with the accumulator and pump system, one great advantage is that the platen may be moved from the low-pressure water reservoir with the 125 pounds pressure due to the air on top of the water until the high pressure is required for the effective stroke, which is usually only about 30 per cent., or even less, of the stroke. In the accumulator system the whole movement of raising the table until the work is accomplished would have to be done with 1,500 pounds pressure; consequently there is a large saving in the new arrangement, where one-twelfth of the maximum pressure can be used for practically 70 per cent. of the movement of the table.



System Applied to Flanging Press.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

A LEADING official of the Montreal Locomotive and Machine Co., which is the Canadian branch of the American Locomotive Co., is authority for the statement that slightly over 200 locomotives will be turned out of the different Canadian plants this year, which would be fully 60 more than had been turned out in any previous year. The output for last year had been 140, and of this number 50 had been turned out by the Montreal Locomotive Co., 25 at the Grand Trunk shops, 5 at the Canadian Pacific Railway shops, 30 at the Canadian Locomotive Works at Kingston, and 10 at the Canada Foundry Co. This year, while the Grand Trunk would not be building any engines, the Montreal Locomotive Co. would turn out 50, the Canadian Pacific would turn out 45 from their own shops, while the Canada Foundry Co. would build 5 for the James' Bay Railway.

Bolton is to spend $11,000 for a new public school.

R. S. Begg is to rebuild his grist mill at Port Elgin.

Oakville is to have a new high school to cost $12,000.

Ottawa East is to spend $10,000 for a new public school.

The Merchants Bank is to build an office at Owen Sound.

Winnipeg is placing the machinery for its new asphalt plant.

W. B. Burrill is asking Brantford for a new site for a foundry.

The new Bell Telephone building at Brantford will cost $40,000.

M. J. Haney has come to terms with way and lighting purposes.

Gordeau & Robbins are to establish a large tannery at Winnipeg.

P. W. Gardiner & Son, Galt, are building a new planing mill.

The Shurly & Dietrich Saw Works, at Galt, Ont., will be enlarged.

Charles Kidd will build a brick dwelling at Hamilton to cost $1,600.

Methodists at Fort Rouge, Man., are to build a $19,300 Sunday school.

The Dominion Coal Company's output for March totalled 228,765 tons.

S. McLeod is erecting a $7,000 block of buildings at Prince Albert, Sask.

A $16,000 church will be erected by the German Lutherans in Winnipeg.

Summerside, P.E.I., is to install a sewerage and water works system.

The C.N.R. is to erect a new station at Port Arthur at a cost of $38,000.

W. F. Robertson, Hamilton, has secured a permit for a $1,500 dwelling.

The Dominion Suspender Co. is to erect a new factory at Niagara Falls.

The Doherty Manufacturing Co. is putting up a brick warehouse at Sarnia.

The Canadian Steel Goods Co., of Toronto, are negotiating for a site in London.

The Canadian Shovel Co., Hamilton, have secured a permit for a $15,000 factory.

Porter Bros., of Heward, Assa., have commenced the mason work on a stone block.

G. Slade, London, has been issued a permit to erect a cottage on Inkerman street.

Anthracite coal from the Banff mines will be delivered in Winnipeg after June 1.

The Pease Furnace Co. are to establish a new foundry in Toronto, to cost $25,000.

A German company are taking steps to secure mineral lands in the Sudbury district.

The Norris Manufacturing Co. are to erect a large factory in Winnipeg this Summer.

The Gilmour Door Factory has decided to erect a large fine new warehouse at Trenton.

A power-house for the new electric railway at Chatham is to be built this Summer.

The foundations of Banfield & Co.'s new warehouse at Winnipeg have been completed.

The Gilmour Door Co., Trenton, are to spend $75,000 in extending its buildings and plant.

George Wright & Co. are to erect a five-storey stone and brick hotel at Winnipeg.

The Hoover Block in Winnipeg is to be changed into a labor temple at a cost of $25,000.

James Winram is building a brick block at Pilot Mound, Man., for general store business.

The Doherty Manufacturing Co., Sarnia, are building an addition to their foundry.

Brantford water commissioners have decided to ask for tenders for three new tubular boilers.

Messrs. Smith & Wilby will start a foundry at Toronto for the manufacture of steel castings.

Charlottetown, P.E.I., has been granted power to build a municipal electric light or gas plant.

The D. Conboy Carriage Top Mfg. Co. propose to build a new factory in Toronto to cost $60,000.

The New Brunswick Telephone Co. is to erect a large exchange and office building at Fredericton.

A new company is endeavoring to secure the right to install a gas and electril light plant at Galt.

Bulman Brothers, Winnipeg, whose building was destroyed by fire last Fall, are preparing to rebuild.

Wm. Whyte, vice-president of the C.P.R., intends erecting a $30,000 mansion at Fort Rouge, Man.

English capitalists are dickering for a site in Hamilton or Brantford for a new galvanized iron factory.

The contract for the erection of a $48,000 school at Regina has been let to A. Kallenbrunner, Regina.

The American Furniture Co., Oxford, N.S., who lost their property by fire recently, intend to rebuild.

Building operations have been commenced on the Small & Bucklin lumber mills at New Westminster.

Wake & Carlson are erecting a $10,000 machine shop at Minnedosa, near the new hotel being built there.

The Hamilton Silicate Brick Co. have taken out a permit to construct a concrete factory, to cost $1,500.

The Canadian Saw Co., Limited, St. John, N.B., is installing new machinery and may build a new factory.

Wm. Paterson & Son, Brantford, have increased their biscuit factory by adding a large five-storey warehouse.

The foundations are being laid for a large brick fireproof foundry for McEachern Brothers at Souris.

An American firm has purchased the factory formerly occupied by the Cockshutt Plow Co., at Brantford.

The Diamond Flint Glass Co. proposes to establish a branch factory at Winnipeg and employ 100 to 150 hands.

The trustees of the Methodist church at Minnedosa, Man., are calling for tenders for an extensive addition.

The B. C. Electric Railway and Lighting Co. have purchased the Victoria Gas Co. for about $200,000.

The N. B. Foundry, at Fredericton, is to extend its plant and go into the manufacture of railway mouldings.

The Canadian Pacific Railway will build a new depot at Medicine Hat, the estimated cost of which is $20,000.

A saw mill having a capacity of 12,000 feet of lumber per day will be built at Kawatsie, 180 miles from Vancouver.

J. R. Eaton, Orillia, has secured the contract to build a $10,000 church for the St. James' congregation in that town.

The Toronto Gas and Gasoline Engine Co. has secured a site on which they intend to erect a $15,000 factory.

A saw mill capable of producing 3,000,000 shingles yearly, is being erected by James McNair, at Arthurette, N.B.

The Cleveland Roofing Co. have announced their intention of seeking a Canadian location for a branch factory.

A power-house for the Portage la Prairie waterworks is to be built by Charles Jeffrey. The cost will be $9,997.

A. E. Wagdin will erect a two-storey block, 26x60, at Holland, Man. The upper storey will be laid out as a public hall.

The Northern Elevator Co. are building a new elevator at Creelton, Man., and will erect a new one at Rossburn, Man.

The Canadian Machine Telephone Co. has completed stringing the wires for its new system of 400 phones at Peterboro.

The shareholders of the Dominion Coal Co. have ratified the plan for the reorganization of the company's finances, authorizing an issue of $7,000,000 of 35-year 5 per cent. gold bonds, five mil-

lions of which will be issued almost immediately.

The Composite Brick Co. have decided to settle in Regina, and buildings 150x30 feet are already in course of erection there.

Preparations are being made for the construction of a new C.P.R. dock immediately fronting No. 2 shed, Owen Sound.

Clare Bros. & Co., of Preston, have purchased a five-acre site in Winnipeg, upon which they propose erecting a large foundry.

The Town of Prescott has carried a by-law giving the Palmer Piano Mfg. Co., of Toronto, $40,000 to locate in Prescott.

The Northern Varnish Co. is to establish a varnish factory at Owen Sound. Contracts for the building have already been let.

The Dutton Steel Works Co., Toronto, may locate at Brantford. The Heinz Pickle Co. are to erect a station in the Telephone City.

Several hundred thousand dollars will be spent in the new Intercolonial shops and offices at Moncton. The shops will be 150 x 648 feet.

A company has been formed in Blenheim to manufacture hollow cement blocks for the erection of public buildings, residences, etc.

Three hundred miners are on strike at the Acadia Mines at Westville, N.S. The strike occurred owing to the discharge of a stableman.

The two blast furnaces of the Algoma Steel Co. (Lake Superior Corporation) at Sault Ste. Marie, Ont., have been making good outputs.

A by-law has been carried in Regina favoring the spending of $160,000 to complete the water works, sewage and electric light systems.

The total output of the Boundary Mines in B. C., for the first quarter in 1905, amounted to over 230,000 tons, valued at over $1,000,000.

The large addition to the buildings of the Canadian Heating & Ventilating Co., Owen Sound, is nearly completed. The walls are built of concrete.

The Cyclone Wire Fence Co., and the Woodstock Wire Fence Co., the latter backed by Ann Arbor, Mich., men, have secured sites in Woodstock.

The new Canadian Fairbanks Co. are endeavoring to secure a site for a large factory in Toronto, where the Fairbanks scales will be manufactured.

The Sault Ste. Marie Pulp and Paper Co. have commenced the manufacture of tarred building paper. The plant has a capacity of 20 tons per day.

Berlin has refused to offer the Dennis Wire & Iron Works Co. $15,000 to locate in Berlin. The vote was a few short of the required number.

The Detroit Oil Exchange, of Arizona, has been granted power to do business in Ontario. W. A. Drake, of Leamington, is the company's attorney.

The Niagara Construction Co., Niagara Falls South, will receive tenders for about ten miles of wire fencing, including steel gates and cedar posts.

A combine of all the big mines at Rossland has been accomplished. The amalgamation will result in a saving of over $1 per ton in handling ores.

A combine of all the big mines at Rossland has been accomplished. The amalgamation will result in a saving of over $1 per ton in handling ores.

Toronto has awarded the contract for a six million gallon pumping engine for the waterworks to the John McDougall Caledonian Iron Works, Montreal.

J. H. Ashdown Co., Winnipeg, will add four storeys this year to their two storey office and store building on Main street, at the corner of Bannatyne.

George McKenzie, a prospector, claims to have discovered a vast coal area in Northern British Columbia, near the proposed line of the Grand Trunk Pacific.

One of the greatest mining districts in Canada is to be opened up in Southeast Kootenay by the Kootenay Central Railway, which will be built this year.

The Pacific Coast Steel Co., which is establishing a $500,000 pig iron plant at Seattle, has purchased several iron mines, one being on Texada Island, B.C.

One of the greatest mining districts in Canada is to be opened up in Southeast Kootenay by the Kootenay Central Railway, which will be built this year.

The Nova Scotia Steel and Coal Co. shipped their first cargo of pig iron from the Sydney mines furnaces this season on April 28 by the Micmac for Philadelphia.

The Manitoba Iron Works, Winnipeg, are extending their forge shop to double its present size to provide space for heavy bolt forging and threading machines.

The Economic Construction Co., Toronto, is endeavoring to secure a franchise from Sydney, N.S., for the erection of a gas plant to cost about $60,000.

The Lakefield Portland Cement Co. are putting up new buildings and making additions to their plant. The Owen Sound Iron Works Co. have secured the contract.

Stewart & Witton, Hamilton, have prepared plans for a large seven-storey building for C. J. Myles, which, when completed, will be the highest building in the city.

The William Hamilton Mfg. Co., Peterboro, have secured the contract for equipping the new dredge Emerson, to be used on construction work on the Trent Canal.

Clare & Brockest, Winnipeg, agents for Clare Brothers & Co., Preston, are building a large warehouse at Winnipeg. The erection of a foundry is also contemplated.

The Ogilvie Milling Co. are to build an addition to their mill at Montreal. When completed the capacity will be 5,000 barrels per day, the largest in the British Empire.

McKeough & Trotter, Chatham, have secured additional premises and will manufacture gasoline engines, automobiles, etc., as well as continuing their foundry and boiler works.

Building permits in Winnipeg have passed the million and a half mark this season. Over $1,000,000 worth are under way in Neepawa, $150,000 in Brandon, and $250,000 in Calgary.

A substantial addition is being made to the plant of the Wilkinson Plow Works at Toronto Junction, which will add greatly to the output of this firm and increase the staff of employes.

Construction of the pulp mill to be established at Swanson Bay, B.C., by the Oriental Power and Pulp Co., will commence in May. The mill will have a capacity of 100 tons of paper a day.

The Cochrane ranch, composed of 66,000 acres of land in Southern Alberta, has been sold by H. A. Mullins, general manager, to American capitalists, who will colonize it. The price is $400,000.

Frederic Nicholls, Toronto, president of the Toronto and Hamilton Railway Co., will receive tenders for the grading, culverts, masonry, bridges, etc., required between Toronto and Niagara Falls, Ont.

The D. Hibner Co., of Berlin, have agreed to take over the Listowel chair factory and operate it for ten years in return for certain concessions. They will spend $10,000 in extending the plant.

In 1904 the mineral production of Ontario was $11,737,647, of which $5,071,677 was metallic and $6,665,970 non-metallic. Wages amounting to $3,838,583 were paid to 10,281 employes.

A large United States concern is looking for a site at Port Arthur for a branch factory to make barbed wire, fencing, nails, etc., for the Northwest trade. About $200,000 will be spent on the plant.

Brantford will have no pickle factory for this year at least. The Heinz people will content themselves with erecting the big pickling station and the shipments will be made to Burlington for manufacture.

The Morris Gasoline Engine Co., a firm which at present has a large plant in the United States, intend locating in Canada, and look favorably upon Toronto Junction, which their representatives have visited.

J. D. Sowerby & Co., of Oak Bay Mills (P.Q.) are rebuilding their saw mill, which was burned last year. They have ordered a 150-horse-power engine and a heavy rotary saw mill from the Robb Engineering Co.

The coal shipments of the Nova Scotia Steel & Coal Co. for the first three months of the present year amount to 62,126 tons, against 62,361 tons for the corresponding period a year ago, or a decrease of 235 tons.

The Pneumatic Horse Collar Co., is being organized at Brantford. The company will manufacture a pneumatic horse collar of a patented design, which is claimed to be a great improvement on all present collars.

Mr. J. Morrison, of New York, who is interested in mining, and is associated with capitalists, has secured options upon certain properties in the northern part of Hastings County, with a view to developing the same.

The Ontario Wind Engine & Pump Co., Limited, Toronto, have just received a rush order for two Canadian airmotor outfits from their agent in Paris, France. This is not the first order filled by this firm from France.

The contract for the fireproofing of the new branch of the Molsons Bank, which is being erected at St. Henri, Quebec, has been let to the Pedlar People.

of Oshawa, Ontario, manufacturers of metail ceilings, walls, shingles, etc.

A company with a capital stock of $50,000 has been formed in Pembroke for the manufacture of incubators, cooking ranges, boilers, heaters, agricultural implements and generally to make everything needed by farmers or dairymen.

The Union Drawn Steel Co., which is to build a large factory at Hamilton, has decided to install a plant in temporary quarters and begin to manufacture drawn steel about July 1. Between 50 and 60 men will be employed.

The Western Electric Light and Power Co., Brandon, Man., propose to undertake an extensive water-power development on the Assiniboine River, five miles east of Brandon. Tenders will shortly be invited for a new armory, Brandon.

The McLachlan Gasolene Engine Works Co., Toronto, are so rushed with orders that one for $53,950 worth of engines for use in the Northwest has been refused. The company is to erect new shops at Swansea and double their output.

The Metal Shingle & Siding Co., of Preston, have secured the contract for the ceilings in the new store which is being erected by T. Lindsay in Ottawa, and also the large store which is being erected by the T. Eaton Co. in Winnipeg.

The Vancouver Coal Co. have decided to build the new tipple and trestle at Coal Creek of steel. The new tipple will have a daily capacity of 4,000 tons, and every effort will be made to rush the work to completion as soon as possible.

The Dominion Steel Co. is issuing $1,000,000 more of its second mortgage bonds, and $750,000 will be applied at once to extending the plant at Sydney. Three blast furnaces will be operated as soon as the new coke ovens are completed.

The Manitoba Construction Co. have practically completed their work on the new C.P.R. shops at Winnipeg. Modern machinery is now being installed, including a crane capable of carrying a 100-ton locomotive the full length of the shops.

Tenders are being invited for the construction of a four-storey warehouse in Winnipeg for the Thomas Davidson Manufacturing Co., Montreal, also for three additional storeys to the warehouse of the Consolidated Plate Glass Co., Winnipeg.

The plans for the construction of the new block for Mr. J. A. M. Aikins, at Winnipeg, are now in the hands of local contractors. The cost will be in the neighborhood of $300,000, and promises to be one of the most complete buildings in the city.

The Hospital Committee, Orillia, Ont., will make a canvas for funds for the proposed hospital, which is estimated to cost $15,000. J. H. Wilson intends building a brick block, two storeys, 50 feet frontage, divided into three stores.

Work on the new peat plant at Fort Frances has commenced. The estimated cost of the plant is $50,000. As soon as the first plant has been tested two more will be added making three complete plants costing $150,000 and employing 200 men.

The Rideout-Gilbert Co., Limited, of Rat Portage, have taken over the business of the Gibson-McLaughlin Carpet Co., Winnipeg, and will operate a house furnishings department store in Winnipeg, as well as establish a mattress factory at Rat Portage.

The annual meeting of the Winnipeg Land and Mortgage Co. has been held. A cash dividend of $8 a share was declared, and a bonus in stock of $33.33 also. The capital of the company is $100,000, of which $60,000 is subscribed and $38,000 paid up.

The Montreal Lumber Association of the Montreal Board of Trade. has been organized, with thirty members enrolled, comprising all the most important firms connected with the lumber business. Ald. J. F. Marchand is the president of the association.

The secretary of the Peterboro Lock Manufacturing Co., Peterboro, Ont., is inviting tenders for the erection of complete new buildings. According to plans the main building will be 175 feet by 11 feet, and three storeys high. The foundry will be 160 feet by 70 feet.

The Northern Elevator Co. have completed arrangements for the erection of a new flour mill in Winnipeg. The new mill will have a capacity of 3,000 barrels per day, and the elevator, which will be erected to supply the mill, will have a capacity of 250,000 barrels.

The Lake of the Woods Milling Co. will triple their capacity by building two new mills, one at Montreal with a capacity of 4,000 barrels, and one at Winnipeg, with a capacity of 5,000. This will put this company well in the front rank of milling companies of the world.

A project is on foot to establish a large smallware factory at Haileybury, to manufacture handles and other woodwares. The company proposes to spend $100,000 within the next year, and $500,000 within three years. W. D. Davidson, Rawdon, Que., is behind the project.

Western towns are busy getting ready to make extensive local improvements. Prince Albert will spend $160,000 in sewers, sidewalks, and water works; Calgary $60,000 for an electric light plant, and Indian Head $150,000 for sewers, light, fire protection, and waterworks.

The Vancouver City Council has been asked to guarantee 2 per cent. bonds to the extent of $800,000 of the Vancouver Shipbuilding Co., which proposes to erect a drydock. The Government has given a subsidy of 3 per cent. on an expenditure up to a million dollars for twenty years.

A steam shovel has recently been purchased by the Northern Mines Co., Limited, Atlin, B.C., from the Vulcan Iron Works Co., Toledo, Ohio. This is the first steam shovel to be used for placer work in that district, and it is anticipated that others will soon be used for the same purpose.

Building permits have been issued authorizing Stephen Jones, of Victoria, to erect a building in Vancouver to cost $70,000, and to add two storeys to the block being erected by Dr. Powell at the corner of Richards and Pender streets. This will bring the total cost of that building to about $40,000.

The Cape Breton Coal, Iron and Railway Company have awarded contracts aggregating $30,000 for the erection of buildings at their colleries at Broughton, Cape Breton. The buildings include a hotel, private residence, and general offices. The company will spend $250,000 there this Summer.

Clare Bros. & Co., of Preston, are making large additions to their plant to enable the company to meet increasing demands for their product. The new additions include a one-storey building, 60x30 feet, a moulding shop, 95x100 feet, and a three-storey pattern storage warehouse, 36x85 feet in size.

For ten months ending April 30, the sum of $911,007 was paid out in Canadian bounties on iron and steel, on lead $407,165, on crude petroleum $213,148, and on binder twine $9,167. For the same period of 1904 the iron and steel bounties amounted to $679,322, so that the payments for the present year show an increase of $271,685.

The United Nickel Co. are asking the Ontario Government for power to take over the Rolling and Huronian companies, which control 3,750 square miles of territory near Sudbury. If granted this will give them control of practically all the nickel industry in New Ontario, with the exception of deposits along the Temiskaming Railway.

New Westminster is becoming a seaport. Steamer Amur, of the C.P.R. fleet, this week took on at that city a cargo of 350 tons of steel rails for the Klondike Mines Railway Co., which is constructing a line from Dawson to connect with the principal creeks of the district. The rails came overland from the eastern states.

Among the projected buildings in Winnipeg is one to be built near the northeast corner of Main street and Jarvis avenue for Harrison Bros., at a cost of $14,000, to be used as a store and apartment suites; and a large hotel, to be erected on the northwest corner of Main street and Sutherland avenue by a Moose Jaw resident.

An order-in-Council has been passed creating the Temiskaming Mining District, covering the areas of the rich silver cobalt deposits discovered on the Temiskaming Railway, and a considerable district to the north. The head office of the district will be at Haileybury, and will be in charge of Mr. Geo. T. Smith, of Mattawa.

The Dominion Coal Co. has added 150 new steel cars to its rolling stock. The new cars are the largest in use on any railway in Canada, having a capacity of fifty tons, or five tons greater than the largest previously in use by the company. These new cars will be able to hold a half day's output of all the collieries of the company.

Statuary marble, the equal of any in the Carrara quarries of Italy, has been discovered by two English decorators near Madoc, and quarries are now being worked, 15 men being employed. The promoters claim that, as a result of their find, sculptors, who now have to pay £4 a foot for Carrara marble, will be able to buy it in Canada for $1.

R. Tait, representing Ontario capital, is contemplating the erection of a large saw mill at New Westminster for eastern trade. The firm of Small & Bucklin are also engaged in putting up a large

mill at the same place, and L. W. David the new owner of the old Ross-McLaren mill, the Fraser, which has lain idle for ten years, is ready to start shortly.

Actual operations on the pulp mill to be installed at Swanson Bay, on the northern coast of British Columbia, will be commenced shortly by the Oriental Power and Pulp Co. A wharf, warehouse and saw mill have already been erected. The mill is designed to have a capacity of 100 tons of paper per day, though at first half that output will be made.

Burrow, Stewart & Milne, Hamilton, have found it necessary to enlarge their factory, and work on the excavation for the foundations of the additions has commenced. The four-storey warehouse building on Hughson street will be extended to the limits of the company's property, and the molding shop will be enlarged. The additions will cost about $15,000.

The Dominion Coal Co., of Glace Bay, N.S., have, it is said, purchased 30,000 tons of steel rails from the Cumberland Railway aad Coal Co., and are negotiating for the purchase of 250,000 tons more. The Cumberland Railway and Coal Co. are replacing these with heavier rails. The old rails will be used by the Dominion Coal Co. in their yards and sidings.

The Crofton smelter, on Vancouver Island, erected for the handling of ores from Mt. Sicker camp by the owners of the Lenora mine, has been sold to the Britannia Copper Syndicate, which owns the Britannia mine on Howe Sound, near Vancouver. This mine is being rapidly put in shape to produce, and the ore will be sent to the Crofton smelter for reduction.

The Expanded Metal & Fireproofing Co., Toronto, have purchased the Canadian rights of the Jarvis system of reinforcing concrete beams, columns, etc., recently patented by Beaumont Jarvis, architect, of Toronto. In the Jarvis beam the cross section of metal is greatest in the centre of the beam, where the greatest bending or tension of the truss is located.

What is supposed to be a rich discovery of iron ore has been made at Riding Mountain, Manitoba, and is causing much local excitement. A sample forwarded to Montreal has proved most valuable if in sufficient quantity. As soon as possible a shaft is to be put down by parties interested. The surface veins indicate a large bed of ore not far below the ground.

Anticipating the demand for lumber on the northern coast of the province, a company has been formed by Angus Fraser, a well-known logger, to establish a mill at Kawatsie Bay, some 200 miles north of Vancouver. The machinery is to be sent north shortly and the mill will be running early in the Summer. It is possible that water-power will be used to run the mill.

The West Kootenay Power and Lighting Co., which own the power of Kootenay River at Nonnington Bonnington Falls near Nelson, are engaged in developing the upper falls, which will add 25,000 h.p. to the energy available for mining in that part of the Kootenay. Rossland, Nelson and Trail districts are served by this plant. Besides, the City of Nelson has a 5,000 h.p. plant, so that power problems have been solved in that section.

A very large number of artisans and laborers are working on the main line of the C.N.R. on its extension to Edmonton, N.W.T., and the company confidently expect to run trains into the northern town this Summer. There are still 300 miles of steel to be laid before the town is reached, and two bridges to be constructed. The bridges are to be built at Battleford and Fort Saskatchewan.

The Gibson Foundry Co., St. John, N.B., will not probably open up again. During the year that it was in operation the greater part of the work done by its workmen was for the Canada Eastern Railway. When that railway was taken over by the Intercolonial, however, the machine shops at Moncton were naturally looked to as those in which the most work for the road would be done.

The Canadian General Electric Co. have purchased a large block of land in Peterboro in addition to the thirty acres now occupied by them. The expanding business of the company demands large additions to their buildings, which will be made this Summer. The Peterboro Lock Works have also to have more room, and a meeting of the shareholders has authorized the construction of entirely new buildings on a large scale.

The Canada Launch Works, Carlaw avenue, Toronto, have their machine shop, which was started early in March for the manufacture of the "Superior" gasoline engine, in running order. A notice of their purpose to build these engines was in the February number of Machinery. They are now turning out on an average an engine a day. It was hinted by the management that the machine shop would be extended in the near future.

General Manager Cronin, of the War Eagle and Centre Star Companies, has made the statement that the present condition of the two properties will necessitate the employment of not less than 500 men before the end of the present year. The reason for this is the recent discoveries of more high-grade ore in the lower levels of both mines, and the need of an elaborate system of development.

Fort Frances expects to have $270,000 spent on buildings and improvements this year as follows: Peat factory, $50,000; Wells' hardware store, $45,000; J. J. Stone's hotel, $30,000; St. Mary's Hospital, $25,000; industrial school, $35,000; Town Hall, $13,000; Catholic church and school, $9,000; sash and door factory, $3,000; dwellings and stores, $60,000. Over $80,000 was spent in 1904.

The Berlin Electric Co. have been awarded the contract from Clare Bros. & Co., Limited, Preston, for the installation of electric machinery throughout their entire plant. The company is doing away with long shafting and belting, and substituting the electric drive, which reduces the transmission losses from 18 to 25 per cent. They are also installing about 175 incandescent and 16 arc lamps. The equipment throughout will be Westinghouse.

A million dollar hotel will be built in Ottawa this year. It will be located on the present site of the Grand Union Hotel, will be eight storeys high and contain 350 rooms. The structure will be fireproof throughout. the walls, roofs, facings, etc., being all of reinforced cement concrete, similar to the Ottawa University. All the decorative and finishing work will be of cement, mixed with crushed marble, which provides a fine effect.

Among recent contracts awarded to Allis-Chalmers-Bullock, Limited, Montreal, were : Three 450 h.p. induction motors; one 100 h.p. induction motor, rope driven, for use in the Royal and Glenora Mills of the Ogilvie Milling Co.; six Type E-24 Ingersoll-Sergeant rock drills for the B. C. Copper Co.; two Ingersoll-Sergeant sub-marine drills for the Montreal Harbor Commissioners; one Gates K crusher with engine and other equipment, to Michael Connolly for his contract at St. Raymond, Que.

The steel works of the Lake Superior Corporation at Sault Ste. Marie, Ont., are now receiving iron ore at the rate of about 35 tons a day from the Williams mine. It is claimed to be of Bessemer quality, and the output will shortly be increased. Another prospective source of supply is a mine situated about 25 miles below the Sault, which will be in operation before long. The steel works are turning out daily between 350 and 500 tons of steel rails on their contract with the Canadian Pacific Railway.

Mr. Julius Peters, of the Record Foundry & Machine Co., of Moncton, N.B., has been in Vancouver for the past week or so looking to establishing a branch of this successful concern in this city, with the object of turning out stoves and other articles which they manufacture in the east. Representations have been made to the city council seeking for some concessions as inducement for the location of the proposed shops here, as other coast cities rival Vancouver in seeking to have the new shops.

A 15-storey building is to be erected in Toronto on the corner of Yonge and Colborne streets, to cost $750,000. The sky-scraper will represent the most modern methods of building construction. One new idea will be a series of doors on each floor, which at a certain degree of heat will close automatically and shut off the elevators and stairways from the remainder of the building. With these in operation the entire building might burn, if it were not fireproof, and the inmates could pass to the stairway and elevator without danger.

It is stated that the management of the Lake Superior corporation contemplates a radical departure from past plans in the completion of the Algoma Central system. The idea has been advanced that it would be best to first build to a junction with the C.P.R., and push on north to the Grand Trunk Pacific, before completing the line from the Soo to Michipicoten. The early completion of the line from the Soo to the Helen mine is not pressing, as the company can lay in enough ore during the season of navigation to last through the Winter.

The Dominion Iron and Steel Co. are said to be preparing for the erection of

plate and angle mills as soon as the rail mill is completed and in operation, which will be about the first of June. The blooming mill of the company has been double shifted, the first time in two years. Other mills will be put on double time shortly. The company has no labor troubles, but about two dozen bricklayers left its employ a week ago because a demand for increased wages was not granted.

The shingle trade of B. C. is in better organization this year than ever before. Two companies, the Export Lumber & Shingle Co., and the Union Lumber Co., have secured contracts for fully 90 per cent. of the output of all the shingle mills in British Columbia, and the mills are thus in a position to feel assured that prices will be maintained. Dealers in the east are holding off till the very latest moment with orders, following their long established custom of waiting for a break in prices. But the millmen declare there will be no price cutting on British Columbia shingles this year.

The Canada Tin Plate and Sheet Steel Co.'s new plant at Morrisburg is to be erected at once. Peacock Bros., Montreal, have completed their work on the plans, and J. Wesley Allison, who has the contract for equipping the plant, claims that it will be the most modern tinplate and sheet steel plant in the world. Being operated entirely by electric power will alone make the Morrisburg mills unique. The mills will be built close to the main line of the Grand Trunk, from which railway sidings will run through the centre of the principal buildings, which will stand in a double row parallel to the main line.

The new foundry erected in connection with the Taylor-Forbes Mfg. Co.'s plant at Guelph, Ont., for the production of radiators, will be in operation in the course of a few weeks. The building is 348 feet long by 80 feet wide and one storey in height. The machinery is of the very latest pattern and was designed and built in the other departments of the factory. The company has also erected a new electrical power plant at a cost of $12,000. A 250 kilowat generator and seven motors aggregating 210 horse-power, have been installed. The system is a 3-phase, 60-cycle induction motor, making it suitable for Niagara power connection.

Financial papers announce that the Ontario-Niagara Power Co. has sold to New York State customers 60,000 horse-power per annum for a period extending to April 1, 1950, with renewal rights for 60 years more. Inasmuch as the company is to develop 125,000 horse-power it will be within its rights in exporting one-half of that. The agreement says that "whenever required" the company shall supply at least one-half of its output to Canadian applicants. If, therefore, during the first year of operation 20,000 horse-power was developed, and there was an application from Ontario for 12,000 horse-power, all the company would be obliged to sell on this side would be 10,000.

Building activity in Vancouver is unprecedentedly great, despite the fact that for years there has been almost abnormal growth. There is not the least indication yet of anything but the ordinary healthy expansion which goes with the rapid increase of the volume of trade in the city. Business blocks of larger size and more substantial character are being put up this year in greater numbers than for several years. Aside from two or three large public buildings, the structures last year were nearly all residential, with a few small blocks. Previous years marked the erection of some good blocks, and again this season the larger class of business building is more in evidence.

Interests identified with the International Nickel Company say there are no prospects of dividends in the near future. While the corporation is earning sufficient money to pay a substantial dividend on the preferred, the management has deemed it prudent to suspend dividend action until a satisfactory working capital has been accumulated. Since the organization of the company practically all the earnings have been put into reconstruction and the general rehabilitation of plants. The stock is not dealt in on any of the exchanges. This is the company which operates the Canadian Copper Company's nickel mines at Sudbury.

Before the end of 1905 there is every likelihood that very great advancement in development of the rich Similkameen district will be recorded. There is absolutely no doubt that the Hill interests will push construction of the V. V. & E. Railway from Midway, the present terminus, at least as far as Princeton. At both places unused hotels have been leased by contractors who will use them for boarding and lodging their men while at work on the road. The application at Ottawa for amendments to the V. V. & E. charter is for the purpose of enabling the line to be built to the international boundary where a slight detour into American territory and then back into British Columbia will get round Sidley mountain without any heavy grades.

A return of $38,000 from twenty tons of ore out of the silver and cobalt mines of Temiskaming was the story told by Willet G. Miller, the Provincial Geologist, before the Canadian Institute in a recent address. The discovery of the ore was made during the construction of the Temiskaming & Northern Ontario Railway in 1903. An interesting fact about the new find is that no plant is necessary to get out the ore, since it is near the surface. Cobalt is largely used in staining glass, especially for producing a deep blue. It is also used for coloring pottery and porcelain. Although similar to nickel, and fit for use in steel, the same as nickel, its price is five times as great, and it is, therefore, not used for that purpose.

To carry out in full the plans for operating the big Britannia mine on Howe Sound, which the Britannia Copper Syndicate are developing in a very extensive manner Mr. Geo. H. Robinson, one of the principal owners of the mine, has purchased the Crofton smelter, on Vancouver Island. The smelter was at first leased from the owners, or an arrangement made for handling the ore from Britannia, but Mr. Robinson concluded a deal this week whereby he becomes the owner. The mine is about ready to ship, as the aerial tramway for bringing the ore to tidewater is completed and the concentrator plant is also nearly ready for work. As soon as this mill is ready ore will be taken out, and from that time on a big force of men will be kept busy sending the rich copper ore from the big mine to the smelter.

It is again reported that a tremendous combination of iron and steel manufacturing companies of Great Britain, Germany, France and other European countries is being organized, which will be antagonistic to the United States Steel Corporation. Practically the entire world's output of steel and iron products will be manufactured by the two rival combinations. The steel interests represented by Charles M. Schwab, it is said, are to be allied with the new European combination. Fully a year ago it was reported from London that negotiations were in progress there, having for their objects the reservation of home markets for steel products, the prevention of "dumping" and the fixing of uniform export prices. The countries represented in the conferences, which originated with the German syndicate, the Deutscher Stahlwerks Verband, were Great Britain, Germany, the United States, Austria and Belgium, and the French manufacturers also were said to be in sympathy with the project.

The Vancouver Power Co.'s tunnel, connecting Lakes Coquitlam and Beautiful, has been completed after 2½ years' work. The tunnel is 12,775 feet long and levels were kept so true that when the final jointure occurred they were not above an inch out from each other. Messrs. Ironside, Rannie & Campbell, of Vancouver, were the contractors for the work, their tender being in the neighborhood of $350,000. The Vancouver Power Co. is a subsidiary of the B. C. Electric Co., and has installed an extensive plant for generating electricity for street rail- the City of Toronto regarding a new iron construction plant in the Ashbridge's Bay district. Mr. Haney will take twenty acres directly east of Cherry street, all but two acres of which is under water. To reclaim the land he will spend about $130,000 in filling in and crib work, the estimated cost of the latter being $90,000. He will employ about 200 hands at the start, being given a lease for twenty-one years at a nominal rental of $300 and a fixed assessment of $20,000. Mr. Haney proposes to undertake large contracts for tunnelling, bridge work, etc., throughout the country.

The Canadian Pacific Railway has placed with Allis-Chalmers-Bullock, Limited, Montreal, an order for four Lidgerwood 25-ton pull Rapid Unloaders. Among modern devices for reducing the cost of railway construction the Rapid Unloader taken a leading place. It is a compound geared winding engine of two sizes—25-ton pull and 60-ton pull—mounted on ordinary flat cars and supplied with steam from the locomotive. The engine of the smaller size just purchased by the C.P.R. Railway has double 10 x 12" cylinders, is capable of exerting a direct pull on the cable of 25 tons, and of drawing in the same at the rate of 125 ft. per minute. The drum is 11" diameter, and is grooved for 1¼" cable. This new device is in strong contrast to the old method of drawing the plow by use of locomotives. It can be operated by any locomotive strong enough to pull the train. By actual test two Mogul locomotives failed to unload by the old method a trainload of frozen

clay after trying for three hours. The Rapid Unloader with an ordinary locomotive unloaded an identical train in seven minutes. The Canadian Pacific Railway have already fifteen of these machines in operation—one of them working at Westmount unloads a train of twenty-five standard flat cars in nine to ten minutes.

Nothing has yet been announced as to the intentions of the U. S. Steel Corporation, and the impression is gaining ground that the recent tour through Western Ontario by the officials of that company was another grandstand play to bluff the steel producers in Canada from urging higher protection from the Government. It is unauthoratatively announced that "if" the Steel Trust invades the Canadian field, $10,000,000 will be spent in plant alone. How this would affect the Canadian manufacturers is a matter of doubt, as the development of the industry might provide enough work for all. Most of the Canadian companies are operating in specialties. The Dominion Steel Works, for instance, turn out rods and structural steel; the Nova Scotia Steel & Coal Co. is a general producer; the "Soo" plant devotes its attention to the manufacture of steel rails; the Hamilton Iron and Steel Co. is actively engaged in structural work, and the Midland Iron Works to the producing of pig iron. The United States Steel Co., with all its resources of wealth and minerals, will be no mean rival to these companies, but the advantage will undoubtedly rest with the Canadian consumer. The reason of the anxiety of the Steel Trust is on account of the imposition by this Government of a duty of $7 per ton on steel rails, and the anti-dumping clause of the new law, levying an extra tax or special duty of $3.50 per ton on rails sent to Canada at cut prices.

The Wisconsin Light & Power Co., of La Crosse, Wis., have placed orders with the Westinghouse companies covering the entire equipment of a large light and power plant. Beside two alternating current generators with an output of 400 k.w. each, which will be driven by Westinghouse-Parsons steam turbines, there are three Westinghouse vertical steam engines, one of which will be connected to a 25 k.w. direct-current generator. The order also includes two motor generator sets, each consisting of a 7½ k.w. direct-current generator and a 15 h.p. Type C induction motor; three 10 k.w. and three 15 k.w. O. D. transformers; one 6,600 volt ten-panel switchboard and one 220 volt arc lamp panel; fifteen low equivalent lightning arresters and choke coils; 25,000 incandescent lamps with Edison base. Roney stokers, manufactured by the Westinghouse Machine Co., will be used in the boiler installation. Activity in application of motors to cranes, hoists, machine tools of every description, is indicated by several orders entered during the week as follows: The Morgan Engineering Co., of Alliance, O., eight railway type crane motors, with a total of 250 h.p.; the Pond Machine Tool Co., of Plainfield, N.J.; twenty-eight Type C induction motors; Niles Tool Works, Cincinnati, O.: five Type S direct-current motors; Long & Allstatter Co., of Hamilton, O.: thirteen Type S motors; the Delaware, Lackawanna & Western Railway: twenty Type CC induction motors; U. S. Hoe & Tool Co., of Columbus, O.: eight Type S motors; the Austin Powder Co.: ten Type C induction motors.

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New Twist Drill Concern.

A company known as the Union Twist Drill Co., capitalized at $600,000, has been incorporated under the laws of Maine to carry on the manufacture of twist drills at Athol, Mass. The president is John A. Macgregor, late superintendent of the Morse Twist Drill and Machine Co. The plant of the Gay & Ward Co. has been purchased, and a large sum will be spent for improvements. L. S. Starrett, of Athol, Mass., is a large shareholder in the company.

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Rock Drills on the Panama Canal.

The last official act of the Panama Canal Commission before resigning was to close a contract with the Ingersoll-Sergeant Drill Co., of New York, for 50 standard rock drills of that company's manufacture, complete with mountings and equipment. These machines are to be used in the removal of rock in the great Culebra Cut through the crest of the Isthmus. The Commission furthermore authorized the same company to remodel a large number of the French-Ingersoll drills, built in France under the patents of the American manufacturers. These machines remain from the original equipment of the old French company formerly operating on the canal. This act of the Commission is interesting as showing the intention of using American machines and American methods in this, the greatest undertaking in the history of rock excavation; while the fact that the old drills are still in a condition to justify their use, shows the superior merit of machinery of American type and design.

* * *

New Quarters.

The Canadian Westinghouse Co., Limited, finding their quarters entirely too small to take care of their increased business, have moved their Montreal office to the third floor of the Sovereign Bank building, 228 St. James street, Montreal.

Power will now be published at 505 Pearl street, New York, where the offices of the company have been moved, instead of at the World Building, as formerly. Their new office is just off Centre street, one block north of the new Hall of Records and three blocks north of the entrance to Brooklyn Bridge.

Alfred Rubbra, proprietor of the Canadian Machinery Exchange at No. 22 Victoria square, Montreal, and also eastern agent for H. Petrie, of Toronto, has removed from the above address to No. 69 St. Antoine street, Montreal. The new premises consist of a large warehouse and office, which will allow Mr. Rubbra to display a complete line of machinery.

* * *

Galvanizing.

Ques. McLean Bros., 910 Main street, Winnipeg, ask for the best process of galvanizing crimped wire goods, so as not to injure the soldered joints in the process.

Ans. The ordinary process of galvanizing, described briefly, consists of immersing the goods to be galvanized in a solution of sulphuric and muriatic acid to remove all foreign substances from the surface, and from the minute pores of the metal. The goods are then dipped in molten zinc spelter, and allowed to remain for sufficient time to receive the required coat of zinc.

This process, however, would not do in the present instance, sinch the molten zinc would destroy the soldered joints. A process of galvanizing by electrolysis has been proposed, which would probably be suitable. However, to our knowledge, such a process has not been developed upon a commercial basis in Canada. Perhaps some of the readers of Canadian Machinery can give McLean Bros. some hints regarding their inquiry.

* * *

Staff Additions.

The business of Allis-Chalmers-Bullock, Limited, Montreal, has increased so rapidly recently that it has been necessary to make a number of important additions to the staff. Mr. T. F. Kenny has been appointed mechanical engineer. He graduated from the department of mechanical engineering at McGill University in 1896, and then spent two years with the British Columbia Iron Works. For the past six years he was mechanical engineer for the Jenckes Machine Co. Mr. James F. Forbes has been appointed to take charge of the pumping engine department. He is a native of Philadelphia, and has had large experience with the water companies owned by the Delaware Company of New Jersey. Later he became superintendent at Dennison and Uhricksville, and had charge of the construction of a slow sand filter plant, and also of a mechanical gravity filter plant. Under his superintendency the pumping facilities were largely increased and rearranged to suit the filter plant. Since 1902 he has been traveling salesman with the National Meter Co., making Chicago his headquarters.

* * *

Doble Water Wheels in Canada.

The Abner Doble Co., of San Francisco, announce that arrangements have been made with the John McDougall Caledonian Iron Works Co., Limited, of Montreal, Canada, whereby the latter become sole licensees for the manufacture of the Doble system of water wheels in the Dominion of Canada. The tangential water wheels and needle regulating nozzles manufactured by the Abner Doble Co. are well known for their excellence of design and workmanship, and considerable engineering interest has recently been shown in relation to the four 8,000 horsepower wheels which that company has built for operation in California power plants. The McDougall Co. have one of the most extensive machine works in Canada, their plant including machine shops, pattern shops, foundry, forging works and structural material shop. Their plant is, therefore, well equipped for the manufacture of water wheels and other hydraulic machinery. They already have in hand the building of a 100 horsepower wheel to operate under 170 ft. head, taking water through a 3¼ in. jet and having a speed of 130 revolutions per minute. The Canadian licensees are prepared to furnish the steel pipe, structural work and all machinery necessary for complete power plants, and the Doble Co. request that all engineers or

parties interested in water power developments in Canada, address the McDougall Co. direct. They have retained the Abner Doble Co. as their consulting engineers.

* * *

Steam Turbine and Generator Outfits.

The number of orders received by the Westinghouse Companies for steam turbines and turbo-generators is convincing evidence of the firm belief which engineers place in this class of apparatus as a source of power. Many units have been installed, some of which have been in successful daily operation for years. For ease and low cost of installation, economy in operation, and minimum space required, such an outfit has no equal and no near rival. This type of apparatus is installed in many places where it becomes necessary to increase the output of the station, and where it is not possible to increase the floor space.

Three of these outfits have recently been ordered by the Public Service Corporation of New Jersey, one having an output of 500 k.w., and two with ratings of 1,000 k.w. each. There is also a 1,000 k.w. turbo-generator being built for the Indian Orchard Co., and a 400 h.p. induction motor with starting device, and two 300 k.w. transformers. Westinghouse, Church, Kerr & Co., are the designers for this station.

The Truckee River General Electric Co., a large power-distributing company of California, operating many high potential lines. will add a 2,000 k. w. alternating current belt-driven generator, four 750 k.w and four 625 k.w. transformers to their present equipment. Westinghouse low equivalent lightning arresters and choke coils are being used for the protection of apparatus, and more will be added.

Companies Incorporated.

The Metallic Roofing Co., of Toronto, has received power to increase its capital stock from $20,000 to $200,000.

The Metal Shingle & Siding Co., of Preston, Limited, have increased capital stock from $50,000 to $200.000.

Stories of fabulous finds of gold in the Temiscaming district of New Ontario are discredited hy the Provincial Bureau of Mines.

A strong company has been formed to work the iron deposits at Black Island, Man. Active work commences next month.

The output of the Dominion Coal Co. for April was 221,541 tons, about 7,000 tons less than during the preceding month.

Mackenzie & Mann are reported to have bought the Tin Top copper mine near Port Arthur. Over 20,000 tons of ore have been uncovered.

The C.P.R. have received 7,000 tons of heavy steel rails from the "Soo." The rails will be used on the main line between Brandon and the coast.

The Michigan and Ontario Oil Co., of Arizona, has been granted power to do business in Ontario. A. R. Bartlett, of Windsor, is the company's attorney.

C.P.R. and mining officials are considering the establishment of a smelter at Medicine Hat to use the great natural gas wells there for smelting low-grade ores.

Canadian Fairbanks Co., Limited, Montreal, have been given power to transact business in Ontario with Chas. J. Brittain, of Toronto, as its attorney.

Sergeant Co., Limited, Barrie, share capital, $50,000; purpose, to deal in fuel and builders' material. The directors are: W. Sergeant, S. Sergeant, of Barrie, and W. A. Sergeant, of Orillia.

Peregrine Coal Co., Hamilton, share capital $40,000; purpose, to deal in fuel. The directors are: J. M. Peregrine, J. G. Sherring, E. H. Darling, F. J. McMichael, and C. E. Peregrine, all of Hamilton.

Chatham Bent Goods Co., Chatham, share capital $50,000; purpose, to manufacture vehicles. The directors are: S. G. Sullivan, Glencoe; A. Park, J. M. Park, G. J. Fielder and F. T. Merrill, of Chatham.

Case Chandler Co., Winnipeg, share capital $50,000; purpose, to deal in building materials. The directors are: W. K. Chandler, J. C. Graham, T. R. Cave, F. C. Hubbard, and A. M. S. Ross, all of Winnipeg.

Jas. Langmuir Co., Limited, Toronto; share capital $25,000; purpose, to manufacture paints, oils and varnishes. The directors are: J. Langmuir, W. Read, G. Ritchie, S. E. Townsend, and H. Dale, all of Toronto.

Ottawa Stone Co., Ottawa, share capital $20,000; purpose, to manufacture huilding materials. The directors are: H. Robillard, B. Robillard, T. G. Brigham, W. G. Hayes, Jr., and P. J. Delaney, all of Ottawa.

J. E. Wilson, Limited, St. John, N. B.; share capital, $40,000; purpose, to do a general foundry business. The directors are: J. E. Wilson, B. J. Wilson, C. Cobham, E. McLaughlin and W. D. Thompson, all of St. John.

The Dominion Coal Co., Glace Bay, N.S., recently placed an order with Allis-Chalmers-Bullock, Limited, Montreal, for eleven new Ingersoll coal cutters. The company had already 175 of these machines in operation.

Ottawa Stone Co., Ottawa, share capital $20,000, purpose to manufacture cement and other building materials. The directors are: H. Robillard, B. Robillard, T. G. Brigham, W. E. Hayes, jr., and P. J. Delaney, all of Ottawa.

Buster Brown Gas and Oil Co., Limited, Windsor, share capital $500,000, purpose to produce gas and oil. The directors are: G. S. Brown, I. E. Brown, J. L. Wentz, E. U. Leh, all of Detroit, and J. W. Hanna, of Windsor.

Western Canada Lumber Co., Brandon, share capital $40,000; purpose, to deal in building materials. The directors are: A. McEachern, R. J. McRae, J. A. McLay, W. C. Stedham, G. McEachern, and J. G. Cumming, all of Brandon.

Montreal Cement Co., Montreal, share capital $500,000; purpose, to manufacture portland cements and take over the business of T. M. Morgan. The directors are: J. Morgan, C. D. Morgan, J. W. Cook, and A. Falconer, all of Montreal.

Western Co-operative Construction Co., Winnipeg, share capital $20,000; purpose, to deal in building supplies and fuel. The directors are: O. Biollo, E. Marchetti, S. Cossavella, D. Volpatti, L. Tomasini, and D. L. Delcul, all of Winnipeg.

Lake Huron Copper Mining Co., Limited, Thessalon, share capital $500,000, purpose to develop mining property. The directors are: J. A. McEachern, of Thessalon, B. B. Danziger, J. Danziger, S. C. Yeomans aad C. T. Brown, all of Chicago.

The Atikokan Iron Co., Toronto, share capital $1,000,000; purpose, to mine and mill minerals. The directors are: J. S. Dovell, W. Bain, R. Gowans, E. W. McNeil, R. Richardson, F. C. Annesley, A. J. Mitchell, and R. P. Ormsby, all of Toronto.

Wm. Clark & Sons, Dundas, share capital $40,000; purpose, to manufacture cast iron and brass work. The directors are: W. Clark, F. Clark, W. F. Clark, F. J. Clark, all of Dundas; and J. Donald and J. L. Clark, of West Flamboro.

Wobun Steamship Co., New Glasgow, Nova Scotia, share capital $48,000; purpose, to operate vessels of all kinds. The directors are: G. Stairs, of Halifax; J. D. McGregor, J. C. McGregor, T. Cantley, G. McKay and H. Graham, all of New Glasgow.

St. Lawrence Engine Co., Limited, Brockville; share capital $40,000; purpose, to manufacture boats, boilers, hardware, etc. The directors are: H. W. Going, W. H. Comstock, R. H. Smart, E. Smart, and C. A. McNaughton, all of Brockville.

Dow-Wadge Implement Co., Limited, Winnipeg; share capital $100,000; purpose, to manufacture and repair machinery. The directors are: D. Dow, Grand Forks, North Dakota; T. Wadge, F. B. Blanchard, J. A. Waugh, and E. E. Sharpe, all of Winnipeg.

Gananoque Bolt Co., Limited, Gananoque, share capital $125,000, purpose to manufacture bolts, nuts and railway hardware. The directors are: W. T. Sampson, E. L. Atkinson, C. A. Atkinson, P. Sampson, and D. Bain, all of Gananoque, and F. B. Cowan, of Franklin, Penn.

Carriage Mountings Co., Limited, Toronto; share capital $40,000; purpose, to manufacture carriage mountings, hardware specialties, and metal goods. The directors are: W. P. Kinzinger, A. Kinzinger, S. A. Kinzinger, G. M. Kinzinger, and R. A. Kinzinger, all of Toronto.

Laurie Engine Co., Montreal, share capital $250,000; purpose, to carry on the business of manufacturing engines and electrical machinery. The directors are: D. Yuile, C. E. L. Portius, A. E. Madley, J. N. Mackie, all of Montreal;

and A. E. Woodword, of St. Lambert, Quebec.

Universal Motors Mfgs., Limited, Montreal, share capital $500,000, purpose to take over the Universal Spring Motor Co., of Toronto, and carry on their business. The directors are: H. F. Leonard, jr., W. G. Morden, J. Gelinas, and A. Padeau, all of Montreal, and H. R. Harmer, of Toronto.

Northern Sulphite Mills of Canada, Limited, Sturgeon Falls, share capital $500,000, purpose to manufacture charcoal and charcoal wood alcohol and biproducts of wood. The directors are: John Craig, London, England, G. C. Loveys, J. M. Ewing, F. Ford, and B. Osler, all of Toronto.

Manitou Oil and Gas Co., Toronto, share capital $1,000,000; purpose, to develop oil, gas and salt properties. The directors are: P. Poirer, of Shediac, N.B.; F. H. Bilk, R. A. Riky, and J. R. Bates, of Shelburne; E. D. Lafleur and John Costigan, of Ottawa; and G. Livingstone, of Cottingham.

Knight Bros. Co., Limited, Burks' Falls; share capital, $150,000; purpose, to manufacture building material, cereal foods, etc. The directors are: H. Knight, W. Knight, W. Sharpe, C. W. Sharpe, J. Hilliar, and H. L. Barber, all of Burks' Falls; R. Clay of Katrine, and A. Barber, of Bowmanville.

Lauire Engine Co., Limited, Montreal, share capital $250,000, purpose to carry on the business of the Lauire Engine Co., and manufacture steam and electrical machinery. The directors are: D. Yuile, C. E. L. Portius, A. E. Madley, J. M. Mackie, all of Montreal, and A. E. Woodworth, of Ste. Lamberte, Quebec.

Gas and Oil Co., of Springvale, Limited, Springvale, share capital $10,000, purpose to develop gas and electric power for heating and lighting. The directors are: S. W. Winger, A. S. Benn, S. G. Holbrooke, W. Crozier, W. Duxbury, S. A. Gray, and R. E. Bowman, all of the Township of Walpole, Haldimand County.

The Pictou Smelting Co., Limited, has been incorporated by special Act with capital of $300,000. The incorporators are: Alonzo R. Bayne, Boston; John U. Ross and John R. Davies, Pictou. A clause in the new company's charter empowering the company to withhold part of workmen's wages to cover cost of insurance against employers liability was amended by the Legislature to make the cost of such insurance a charge on the company if undertaken.

Mr. John E. Burchell and others, of Sydney, Cape Breton, have succeeded in forming a company to be known as the Canada Wire and Nail Company, Limited, with a capital stock of $200,000, the object of which is to manufacture and sell nails, spikes, nuts, bolts, screws, wire and wire fencing. It is expected that at the outset about forty men will be employed. Arrangements are being made with the Dominion Iron and Steel Co. for the necessary supply of raw material.

Experts at the Seal Harbor gold belt at Goldboro, Guysboro County, Nova Scotia, which was discovered last Fall estimate the value of the property at between forty and fifty million dollars. They say it is the richest find in Nova Scotia, if not on the continent of America. Leads show magnificent sights for every foot of them.

The property is owned by the Beaver Hat Gold Mining Co., of Glace Bay, Cape Breton, and one thousand dollars was refused on Saturday for one share.

FORCED DRAFT.

The argument formerly advanced against the use of forced draft, instead of induced draft, that it burns out the grates, seriously injures the boilers, and blows gas and smoke from the fire doors, is now seldom heard. The basis of this opinion originated in the experience of some engineers with plants equipped with fans operated at far above the proper speed. This was the result of installing (through ignorance) a fan too small for the work, and then forcing it above its normal speed in order to secure the desired air volume. As a consequence, instead of creating an ash-pit pressure of $\frac{3}{4}$ to $1\frac{1}{4}$ inches, which is all that is ordinarily required, the pressure was forced up to even 5 or 10 inches, with the attending objectionable results. In one instance, the engineer complained of gas discharged from the fire doors with incidental effects, and condemned forced draft in toto, although he was favorably disposed toward induced mechanical draft. Investigation showed that the fan was being operated at about 12 inches water pressure, which at once accounted for all the trouble.

When forced draft is used, the air as it passes from the ash-pits to the combustion chamber is greatly reduced in pressure, owing to the resistances of the grates and the fuel. Coincidentally, the stack, even if a short one, tends to produce a partial vacuum in the furnace. As a result it is practically impossible to create under proper conditions more than a slight excess of pressure in the combustion chamber, and this should not be enough to force the gases out at the fire doors.

Accurate knowledge regarding the proper application of the fan blower for this purpose, will readily dissipate any false impressions regarding forced draft.

A firm of Birmingham manufacturers are seeking an agent to sell engineers' taps and fittings in Canada. They manufacture largely all lines of engineers' supplies and are ready to appoint an agent. Any enquiries respecting this will receive immediate attention at any of our offices.

CONTENTS.

MACHINERY BUYERS' DIRECTORY.

Readers of CANADIAN MACHINERY are invited to use this directory as a ready reference when seeking to buy and machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principal firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

Abrasive Materials.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.

Air Brakes.
Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Air Receivers.
Chicago Pneumatic Tool Co., Chicago.

Arc Lamps.
Canadian General Electric Co., Toronto.
The United Electric Co., Toronto.

Augers.
Chicago Pneumatic Tool Co., Chicago.

Babbit Metal.
Canada Metal Co., Toronto.

Barrels, Tumbling.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.
Niles-Bement-Pond Co., New York.

Batteries, Storage.
Chicago Pneumatic Tool Co , Chicago.

Bell Ringers.
Chicago Pneumatic Tool Co., Chicago.

Belting, Leather.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Belting Supplies.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal

ending Machinery.
Niles-Bement-Pond Co , New York.

Blowers.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevaut Co., Hyde Park, Mass.

Boilers.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.

Boiler Compounds.
Canada Chemical Mfg. Co., London, Ont.

Bolt Cutters.
National Machinery Co., Tiffin, Ohio.

Bolt and Nut Machinery.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Books, Mechanical.
The MacLean Pub. Co., Ltd., Toronto.

Boring and Drilling Machines.
B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co.. New York

Boring Machines, Wood.
Chicago Pneumatic Tool Co., Chicago.

Boring and Turning Mills.
American Tool Works Co , Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Bulldozers.
National Machinery Co., Tiffin, Ohio.

Cabinets, Tool.
Armstrong Bros. Tool Co., Chicago.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
Rice Lewis & Son, Toronto.

Centering Machines.
Pratt & Whitney Co., Hartford, Conn.

Centres, Planer.
Pratt & Whitney Co., Hartford, Conn.

Chucks, Ring Grinding.
Chicago Puenmatic Tool Co., Chicago.

Chucks, Drill and Lathe.
Ker & Goodwin, Brantford.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Chucking Machines.
American Tool Works Co., Cincinnati.
H. W. Petrie, Toronto.
Potter & Johnston Mach. Co., Pawtucket, R.I.

Circuit Breakers.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westiughouse Co., Hamilton.

Compressors, Air.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton

Controllers and Starters, Electric Motor.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton
Allis-Chalmers-Bullock Co., Montreal

Cotton Belting.
Sadler & Haworth, Montreal.

Cupola Blowers.
Sheldon & Sheldon, Galt, Ont

Cutters, Flue.
Chicago Pneumatic Tool Co., Chicago.

Cutters, Milling.
Becker, Brainard Milling Machine Co. Hyde Park, Mass.

Cutting-off Machines.
Hurlbut-Rogers Machine Co., South Sudbury, Mass.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Tools.
Armstrong Bros. Tool Co., Chicago.
H. W. Petrie, Toronto.
Mechanics' Supply Co., Quebec.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Dies, Opening.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.
The Globe Machine and Stamping Co., Cleveland, Ohio.

Dies, Threading.
Pratt & Whitney Co., Hartford, Conn.

Drawing Instruments.
Mechanics' Supply Co., Quebec

Drills, Bench.
B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.

Drills, Centre.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn
L. S. Starrett Co., Athol, mass.

Drills, Electric.
Chicago Pneumatic Tool Co., Chicago.

Drills, High Speed.
Wm. Abbott, Montreal.

Drills, Horizontal.
B. F. Barnes Co., Rockford, Ill.

Drills, Pneumatic.
Chicago Pneumatic Tool Co., Chicago.

Drills, Ratchet.
Mechanics' Supply Co , Quebec.
Pratt & Whitney Co., Hartford, Conn.

Drills, Rock.
Chicago Pneumatic Tool Co., Chicago.

Drills, Twist.
Chicago Pneumatic Tool Co , Chicago.

Drilling Machines, Boiler.
American Tool Works Co., Cincinnati.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.

Drilling Machines, Multiple Spindle.
American Tool Works Co., Cincinnati
B. F. Barnes Co., Rockford, Ill.
Bickford Drill & Tool Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto

Drilling Machines, Pneumatic
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drilling Machines, Radial.
American Tool Works Co., Cincinnati.
Bickford Tool & Drill Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Drilling Machines, Upright.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto

Drop Forging Dies.
The Globe Machine and Stamping Co., Cleveland, Ohio.

Drying Apparatus of all Kinds.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dust Separators.
Sheldon & Sheldon, Galt, Ont

Dynamos.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London, Ont.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
United Electric Co., Toronto.
Volta Electric Repair works, Toronto.

Electrical Supplies.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London, Ont.
Packard Electric Co., St. Catharines.
The United Electric Co., Toronto.
Volta Electric Repair Works, Toronto.

Electrically Driven Tools and Machinery.
Allis-Chalmers-Bullock, Montreal.
American Tool Works Co., Cincinnati.
H. W. Petrie, Toronto.

Electrical Repairs.
Volta Electric Repair Works, Toronto.

Emery Wheel Dressers.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.

Engineers' Supplies.
Mechanics' Supply Co., Quebec.

Engines, Gas and Gasoline.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Engines, Steam.
The Goldie & McCulloch Co., Galt, Ont.
E. Leonard & Sons, London.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Exhaust Heads.
Sheldon & Sheldon, Galt, Ont.

Expanded Metal.
Expanded Metal and Fireproofing Co., Toronto

Fans, Electric.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
The Smart-Turner Mach. Co., Hamilton
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Feed Mills.
S. Vessot & Co., Toronto.

Files.
G. & H. Barnett Co., Philadelphia.
Mechanics' Supply Co., Quebec.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.

Flue Rollers.
Chicago Pneumatic Tool Co., Chicago.

Forges.
Allis-Chalmers-Bullock, Montreal
Boynton & Plummer, Worcester, Mass
Mechanics' Supply Co., Quebec.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt

Forgings, Drop.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.

Forging Machinery.
National Machinery Co Tiffin, Ohio

Gang Drills.
B. F. Barnes Co., Rockford, Ill.

Gauges, Standard.
Pratt & Whitney Co., Hartford, Conn.

Gear Cutting Machinery.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Gears, Angle.
Chicago Pneumatic Tool Co., Chicago.

Gears, Reducing.
Chicago Pneumatic Tool Co., Chicago.

Generators.
Canadian General Electric Co., Toronto.
H. W. Petrie, Toronto.
The United Electric Co., Toronto.

Grinders, Centre.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Cincinnati Milling Mach. Co., Cincinnati.
Pratt & Whitney Co., Hartford, Conn.

Grinders, Tool.
Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
H. W. Petrie, Toronto.

Grinding and Polishing Machines.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Hammers, Pneumatic.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Heating Apparatus.
Sheldon & Sheldon, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., High Park, Mass.

Hoisting and Conveying Machinery.
Niles-Bement-Pond Co., New York.
The Smart-Turner Mach. Co., Hamilton.

Hoists, Pneumatic.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Hose, Air.
Chicago Pneumatic Tool Co., Chicago.

Hose, Couplings.
Chicago Pneumatic Tool Co., Chicago.

Injectors.
The Canadian Fairbanks Co., Montreal.
Penberthy Injector Co., Windsor Ont.
Rice Lewis & Son, Toronto.

Iron Tools.
Mechanics' Supply Co., Quebec.
H. W. Petrie, Toronto.

Lace Leather.
Sadler & Haworth, Montreal.

Lathe Dogs.
Armstrong Bros., Chicago.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.

Lathes.
American Tool Work Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
The Canadian Fairbanks Co., Montreal.
R. McDougall & Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Sebastian Lathe Co., Cincinnati, O.

Lathes, Automatic, Screw-Threading.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.
Pratt & Whitney Co., Hartford, Conn.

Leather Belt Dressing.
Sadler & Haworth, Montreal.

Leather Belting.
Sadler & Haworth, Montreal.

Leather Belting, Waterproofed.
Sadler & Haworth, Montreal.

Ledgers, Loose Leaf.
Rolla L. Crain Co., Ltd., Ottawa.

Lumber Dry Kilns.
H. W. Petrie, Toronto.
Sheldon & Sheldon Galt.

Machinery Dealers.
The Canadian Fairbanks Co., Montreal.
Machinery Exchange, Montreal.
Mechanics' Supply Co., Quebec.
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Pratt & Whitney Hartford, Conn.

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Niles-Bement-Pond Co., New York.
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American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Cincinnati Milling MachineCo.,Cincinnati
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
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Milling Machines, Universal.
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Becker-Brainard Milling Machine Co., Hyde Park, Mass.
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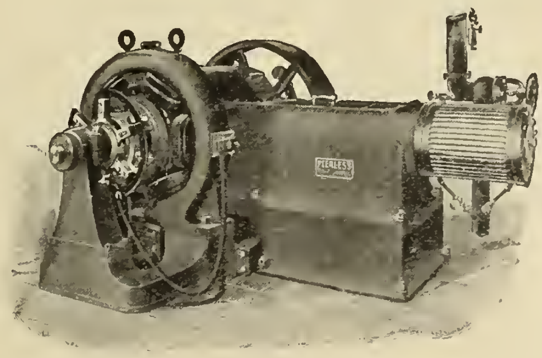

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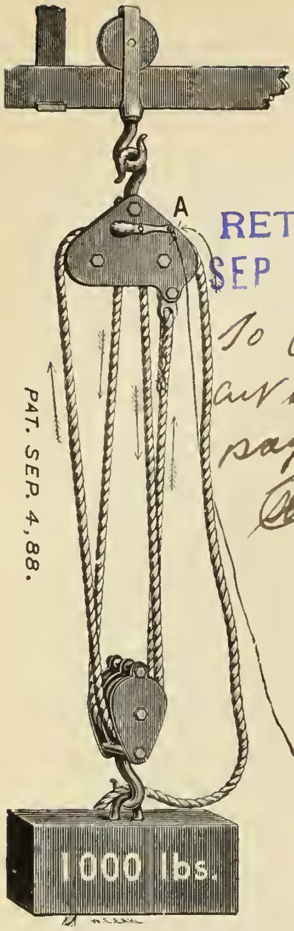

Sure Grip Pulley Blocks

To Owner
of Book
page 9

SIZES IN STOCK

				LBS.		LBS.
No. 3	to be used with	$\frac{3}{8}$ rope,	one man can lift	300	Capacity	600
No. 4	"	$\frac{1}{2}$ "	"	350	"	1,000
No. 5	"	$\frac{5}{8}$ "	"	400	"	1,800
No. 6	"	$\frac{3}{4}$ "	"	450	"	2,500
No. $6\frac{1}{2}$	"	$\frac{3}{4}$ "	"	850	"	4,000

These blocks will hold the load at any point without fastening the rope. The break is simply a wedge that drops by gravity between the upper sheaves and is absolutely automatic in its action. The face of the wedge is fluted in such a manner that the rope is not worn more than by an ordinary block. There is no back slip, which greatly reduces the effort of lifting. The block can be operated from any position.

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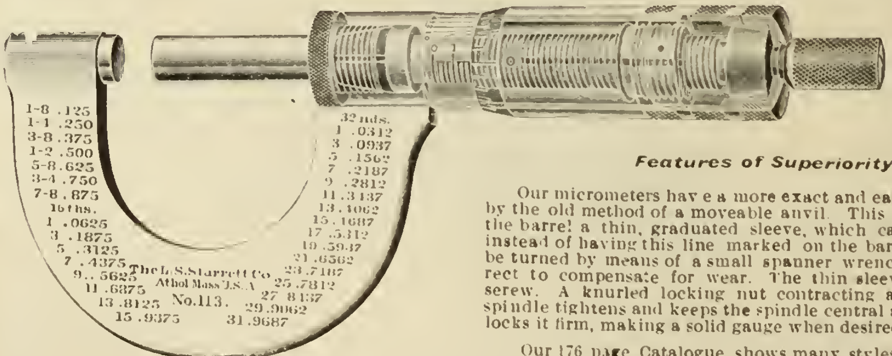

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Features of Superiority—Patented.

Our micrometers have a more exact and easier way of adjustment than by the old method of a moveable anvil. This is obtained by placing over the barrel a thin, graduated sleeve, which carries the base or zero line, instead of having this line marked on the barrel itself. This sleeve may be turned by means of a small spanner wrench to bring the zero line correct to compensate for wear. The thin sleeve also keeps dirt from the screw. A knurled locking nut contracting a split bushing around the spindle tightens and keeps the spindle central and true, or by a slight turn locks it firm, making a solid gauge when desired.

Our 176 page Catalogue shows many styles of Micrometers, from ¼ in. to 12 in., and in Metric from 30 mm. to 300 mm.

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Airoilene
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Automatic Oiling Devices
Bell Ringers, Little Giant
Blow-off Cocks, Little Giant
Chucks, Expanding
Cranes
Drift Bolt Drivers
Drills, Boyer
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Drills, Phoenix Rotary No. 3
Drills, Rock
Drills, Moffet Steam
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Electric Drills, Duntley
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Reheaters
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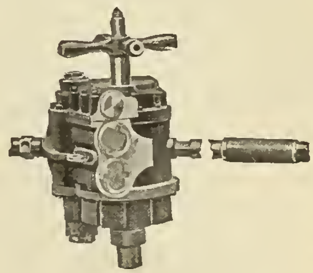
No. 2 Boyer Chipping Hammer



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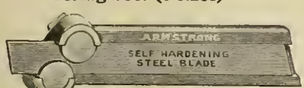
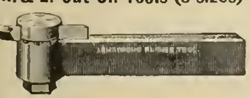
Boring Tool (6 sizes)



Straight Cut-Off Tool (7 sizes)

Threading Tool (5 sizes)

R. & L. Cut-Off Tools (8 sizes)



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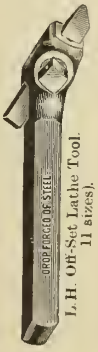

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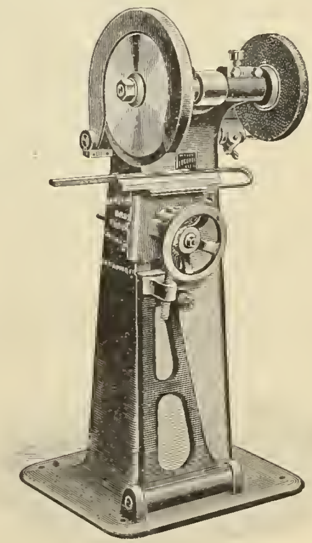

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SAVES TIME, STEEL AND EMERY WHEELS.

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- To ~~Ottawa~~ Montreal
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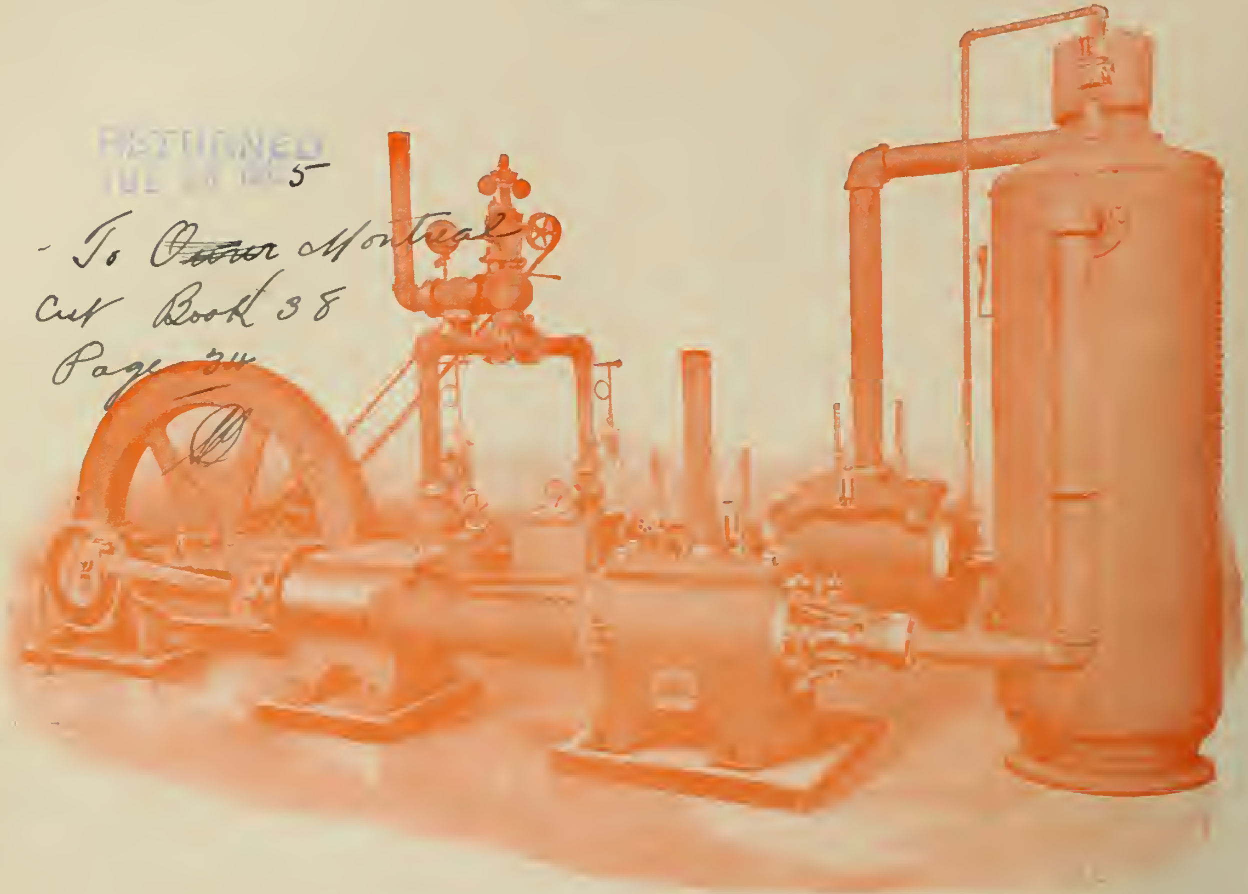
Page 34



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Vol. XVII. (Old Series) (New Series) Vol. I. No. 6

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A MONTHLY NEWSPAPER DEVOTED TO THE MACHINERY AND ELECTRICAL TRADES, AND TO ALL USERS OF POWER

JUNE

MONTREAL = AND = TORONTO

1905

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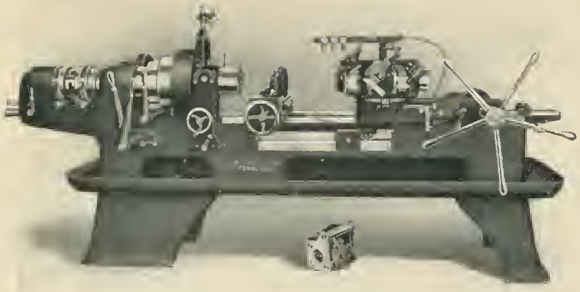

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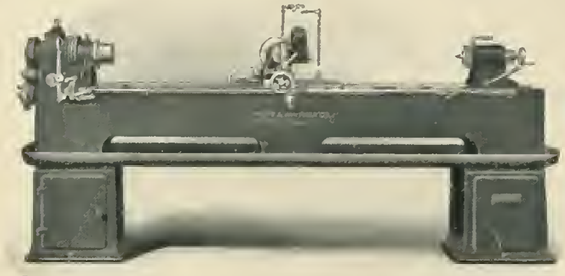

6 x 80 inch Thread Milling Machine. Five sizes. For the rapid production of accurate screws, worms, lead and feed screws and spiral gears.

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Lathe Tools,
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Standards, Gauges,
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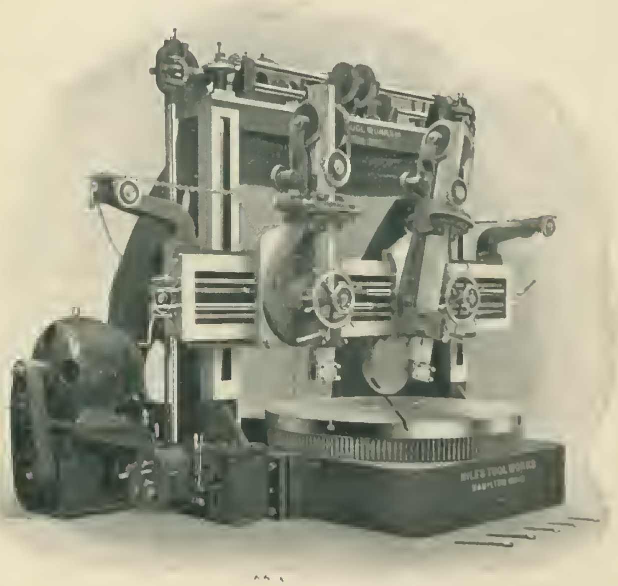
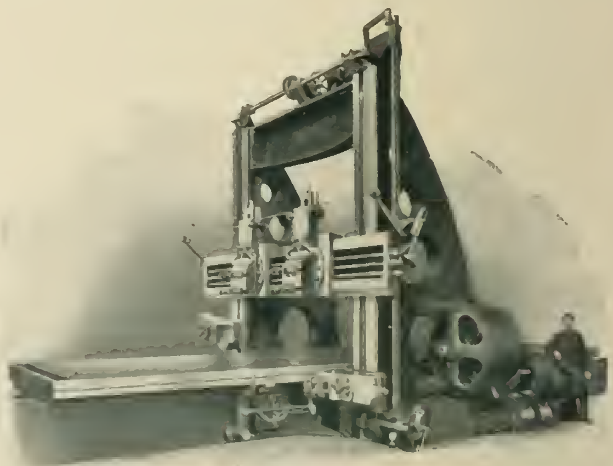
Electric Traveling Cranes and Hoists.



Niles 10-foot Boring and Turning Mill.



10-foot Planer, Pneumatic Clutches. No Belts.

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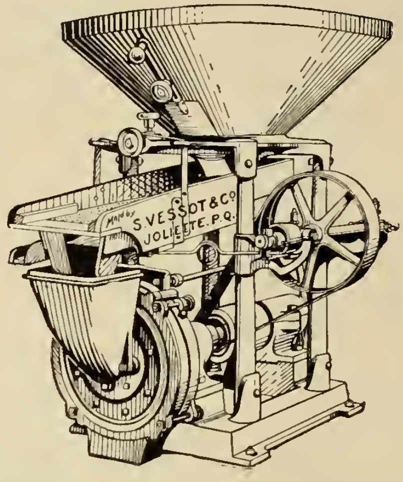
THE MILLER'S BEST FRIEND



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MADE BY THE

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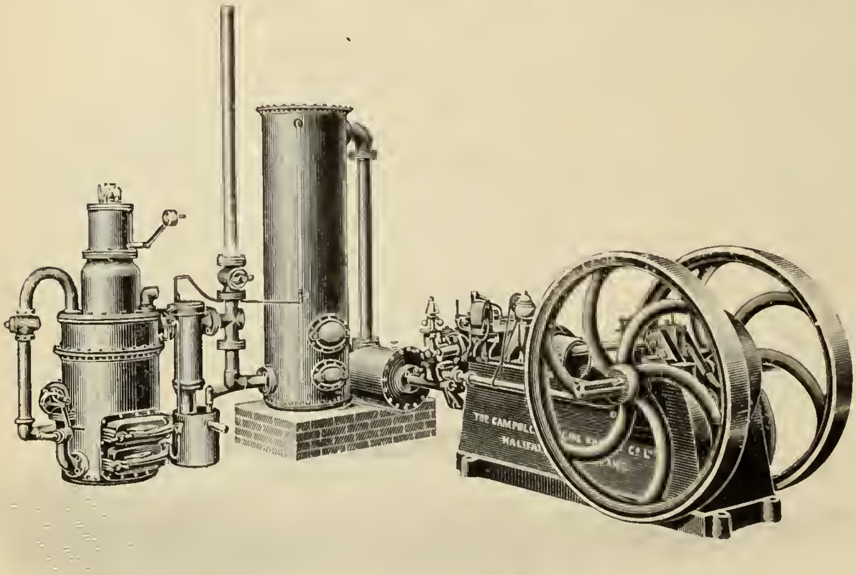

Figures That Talk

Comparative Cost per H.P. per Year:

Electric Power,	$30	to	$80
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We can show you plant in operation in Montreal.

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Builders of Modern High-Standard Machine Tools for rapid work production.

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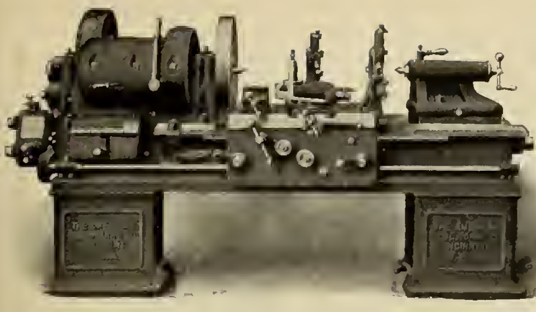
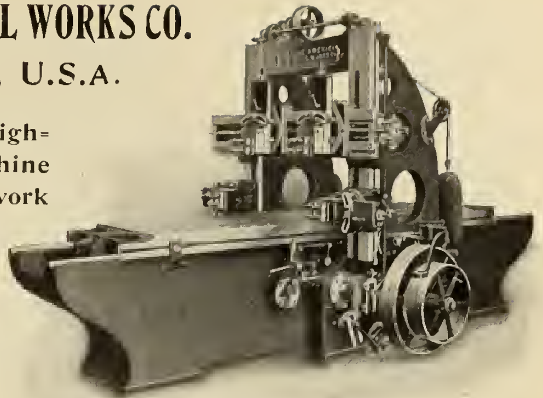


"AMERICAN" LATHES: 14-in. to 60-in. Swing.



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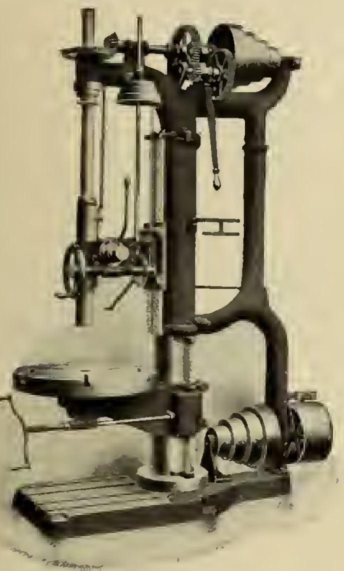
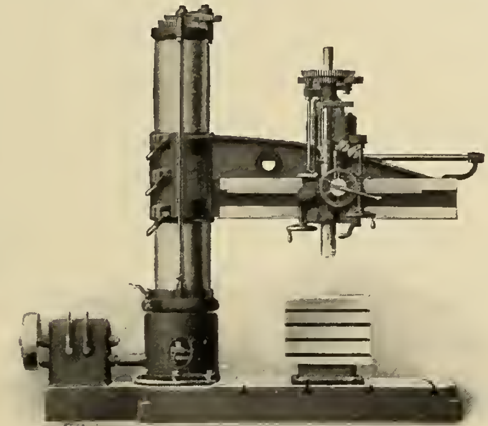
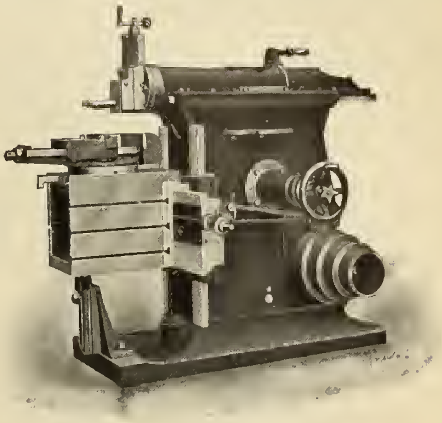


UPRIGHT DRILLS: 13-in. to 42-in. Swing.



RADIAL DRILLS: 3-ft. to 7-ft. Arms.



SHAPERS: 16-in. to 28-in. Stroke

ALPHA

HIGH-SPEED STEEL IN JAPAN

Read the reports of tests made in Japan:

MITSU BISHI DOCKYARD and ENGINE WORKS.

Nagasaki, Japan, June 27, 1903

B. K. MORTON, Esq.,
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Herewith we beg to enclose the results of test made by us.

Yours faithfully, (Signed) Y. SUGITANI,
for General Manager

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B. K. MORTON & CO.

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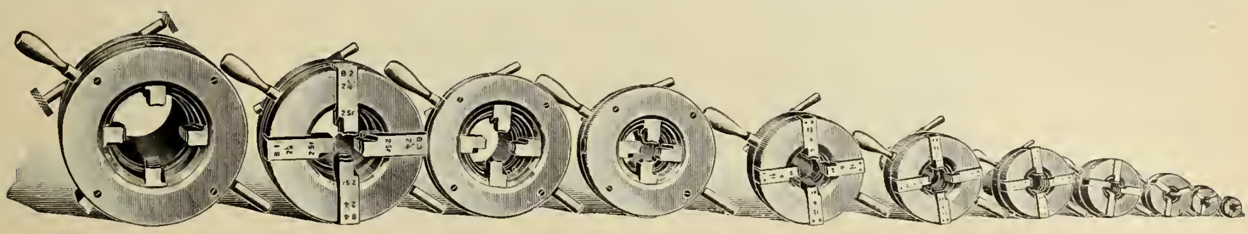

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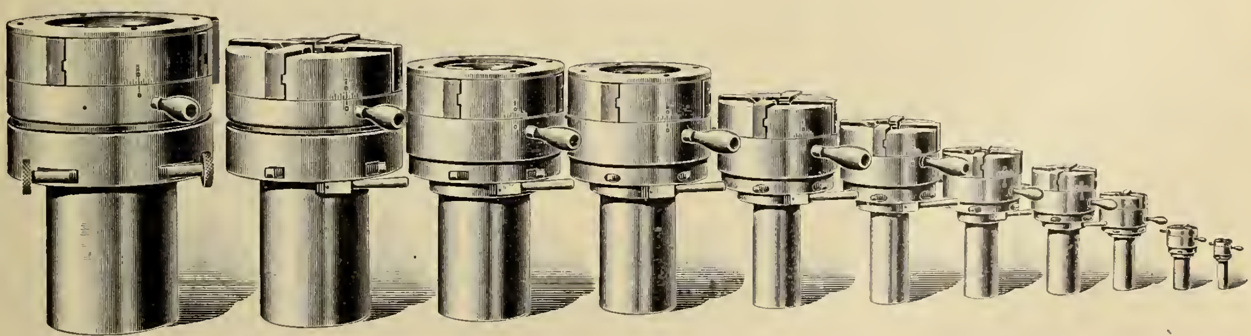

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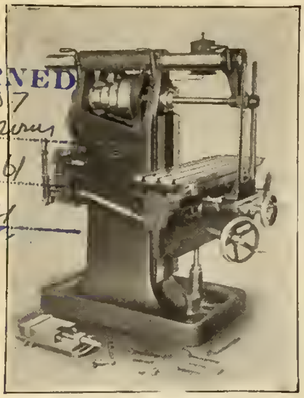

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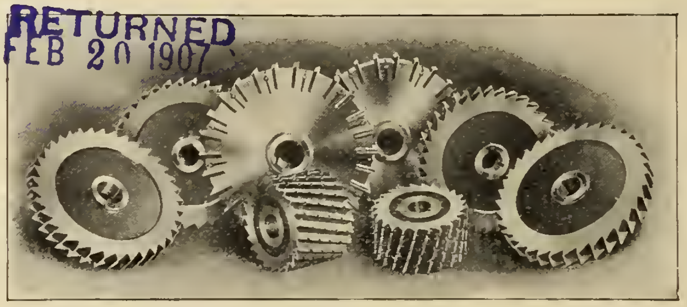

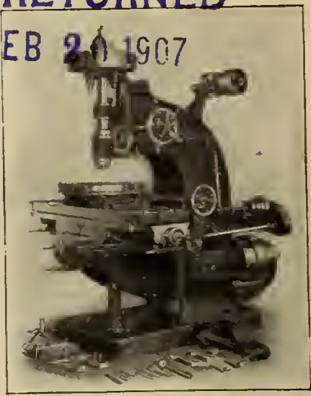

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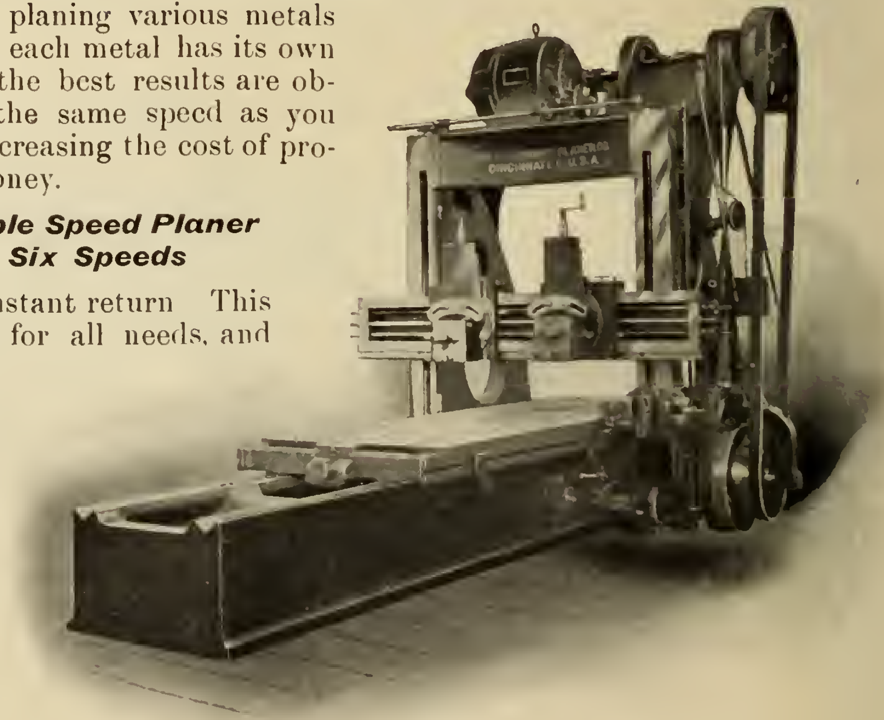

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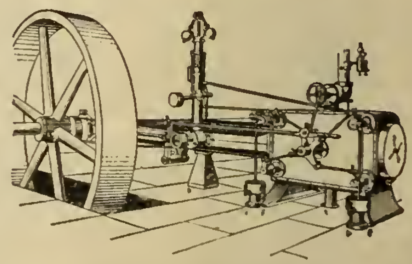

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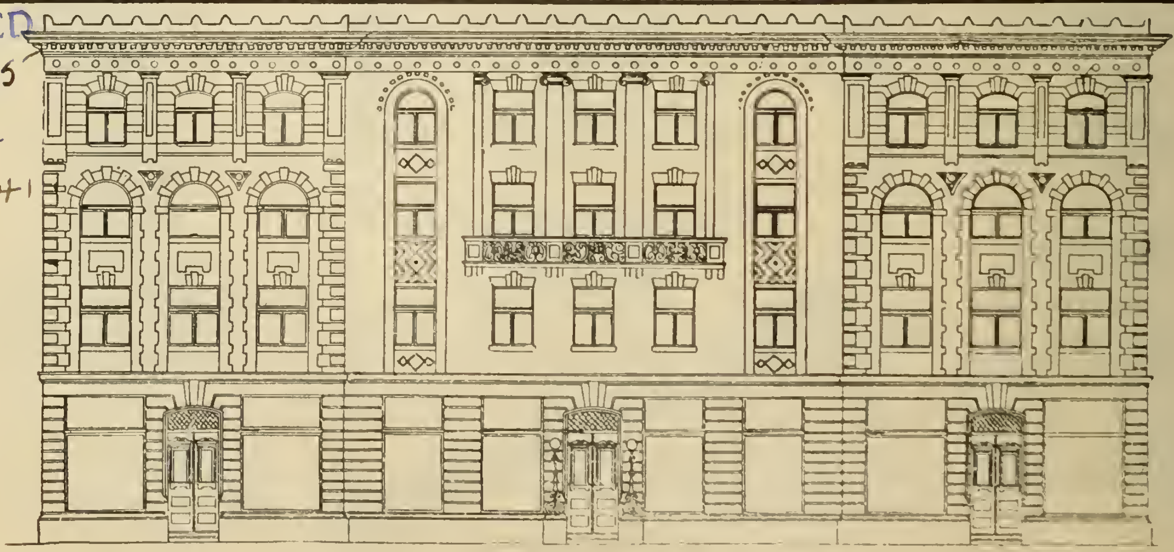

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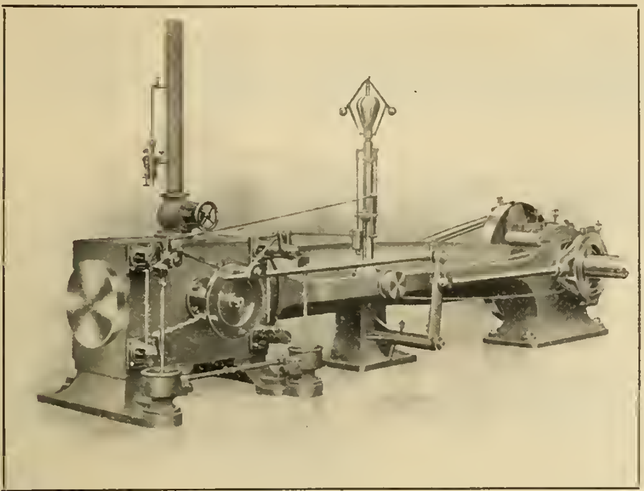

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Modern Canadian Manufacturing Plants

ARTICLE V.—Canada Car Company's Plant—Under Construction—Montreal.

IT was announced in a previous issue of Canadian Machinery that the Canada Car Co. were in the market for a large quantity of machinery, although at that time nothing more had been attempted towards building the plant than to commence placing the concrete foundations. Since then, work has progressed very rapidly, inasmuch as the power house is now completed and the structural steel work finished; so that it is expected to have the entire plant in operation towards the end of Summer.

This company was organized last year with a capital stock of $3,000,000. The officers are: W. P. Coleman, president; N. S. Ruder, assistant general manager; James Coleman, superintendent; E. G. M. Cape, consulting engineer, R. B. Edwards, auditor; all of whom are well known in the business and financial world. It is intended to carry on the manufacture of freight and passenger cars on an extensive scale, and already contracts have been taken, the filling of which will keep the plant running full capacity many months.

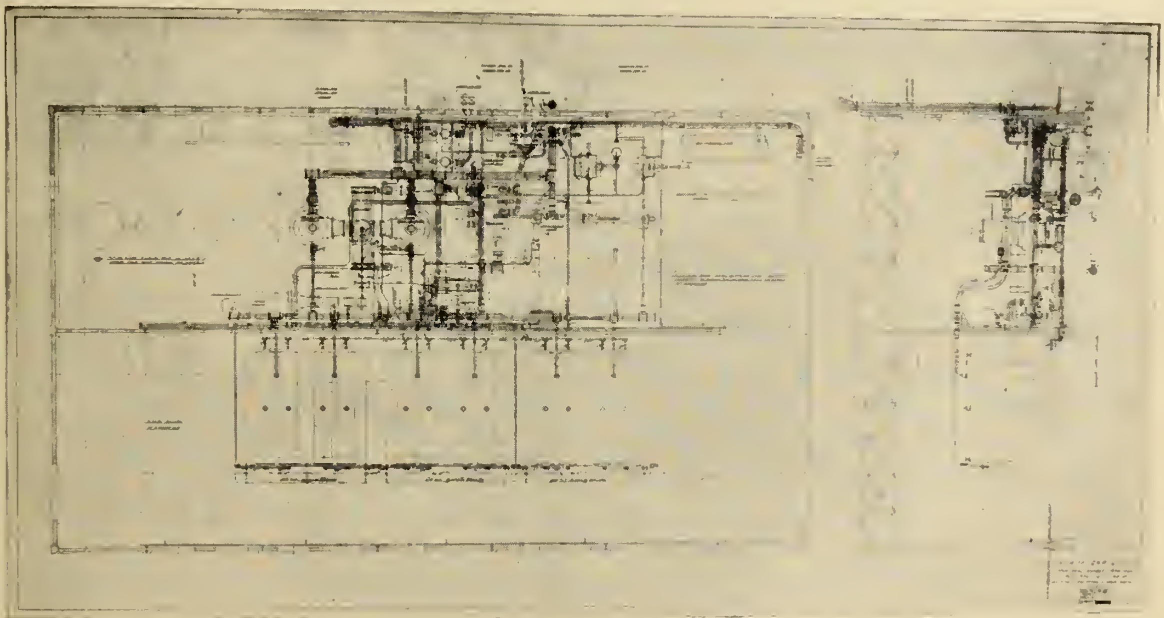
Ground was first broken in September last. The weather proved most favorable to any out-door undertaking, and the result was that the contractors were enabled to finish the foundations before severe weather set in. The work was done by D. G. Loomis & Sons, Sherbrooke, who had a large gang of men at work, thus taking advantage of the favorable weather. The concrete foundations rest on a bed of gravel, varying from four to five feet, which in turn rests on two or three feet of black sand. The closest inspection this Spring failed to reveal any flaw or defect in the concrete work, although the Winter was unusually severe.

General Lay-out.

The property acquired by the company comprises fifty acres, bounded on the north by the Grand Trunk tracks and on the south by the Lachine Canal, just west of Cote St. Paul, affording excellent transportation facilities.

The buildings are divided into two groups, which include the manufacturing departments proper. The offices, power house and store house are separate. Group one includes the planing mill, matching room, cabinet, pattern and carpenter shops, trimmers aad upholsterers, car erection, wheel, axles, truck and bolster shops, as well as the paint shops and tin departments. In group two, are the machine shop, brass foundry, forge and smiths' shop, gray iron foundry and wheel foundry. In the design and construction of these shops, the point kept in constant consideration was to produce the completed cars with the least possible handling of material. Everything pertaining to the makeup of a car will be manufactured; and the capacity of the works when completed will be very large. The arrangement is such as to admit of further extensions at any time. The floor area of the various shops is as follows:

	Feet.
Machine shop	129 x 70
Brass foundry	86 x 70
Forge and smith shop	301 x 70
Gray iron foundry	215 x 70
Wheel foundry	215 x 184
Planing mill	387 x 70
Matching room	236 x 70
Cabinet, pattern shop and carpenters' department	236 x 70
Trimmers' and upholsterers' shop	172 x 70
Freight car erection shop	301 x 70
Passenger car erection shop	301 x 70
Wheel, axle, truck and bolster shops	301 x 70
Passenger car paint shop	301 x 70
Freight car paint shop	322 x 70
Store house	120 x 80



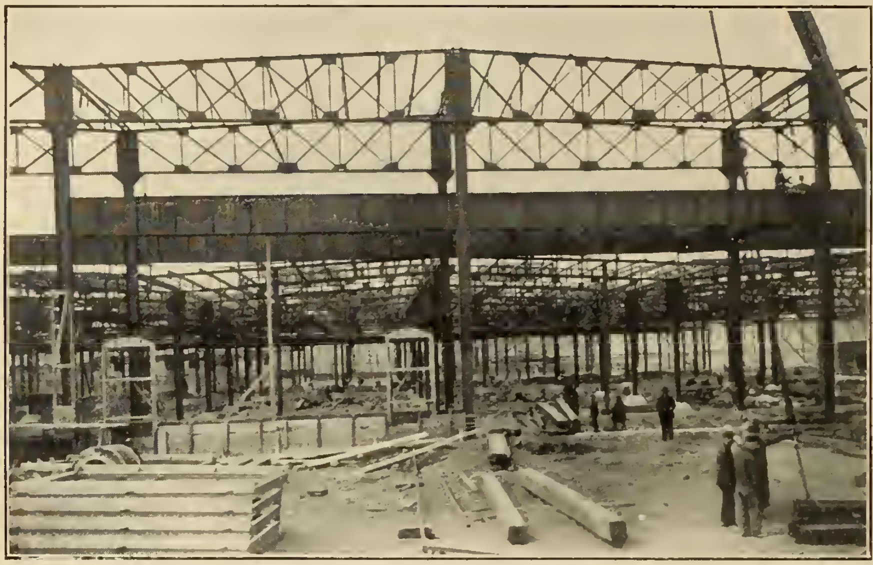
Plan and Section of Power House.

Construction.

The contract for building the larger group was given to C. E. Deakin, of Montreal, and the other to the Forest City Paving Co., who successfully completed the power house during the Win-

ter. The construction of these buildings is proceeding with all possible speed, the work being under the supervision of Mr. E. G. M. Cape, consulting engineer for the company. What has been accomplished within the past few weeks towards that end, is shown by the illustrations. Although there is a great deal of timber visible, but a small amount will go to make up the completed structures. Steel and concrete are the principal materials used. The foundations and walls are entirely of concrete, with steel skeleton work throughout, the roof being of wood covered with felt and tar and gravel. While several round houses and smaller buildings have been erected in Canada with concrete walls, the Canada Car Co. is the first industrial establishment to adopt this method. It has been generally believed that concrete construction could not be carried on with any degree of success during the colder spells of our Canadian climate. That this idea is without foundation has been demonstrated during the past Winter in building the power house of the plant which is now completed and receiving its machinery. Often at a temperature of twelve degrees below zero work was carried on. Snow and cold weather hindered the contractors greatly and added very much to the expense of building, but the work was continued and completed before the arrival of warm weather.

The method employed in building the walls consists in using a form made of two-inch dressed lumber, sufficiently stiffened that no bulging or warping could occur. Heavier forms were used in building the power house walls; here the water was heated and the gravel heated, and on being put in place was covered with burlap and manure for forty-eight hours. This gave the materials a chance for an initial set, and it was found that after that the severest frost effected no injury. At present no heating of materials is required. The forms on being removed leave the wall almost perfectly smooth. On being rubbed down they are given a coating of one to two mixtures, leaving a fairly smooth surface exposed. In adding successive layers the top is roughened with a pick and wet, so that the new concrete forms a perfect union with the part already built.



Side View, Group 2 - Canada Car Co.'s Plant.

Four concrete mixers are kept constantly at work and these supply about forty yards each a day. For this work the company was particularly fortunate in getting a superior class of gravel. The cement used was required to comply with the specifications set forth by the Canadian Society of Civil Engineers.

The structural steel work has been supplied by the Dominion Bridge Co., for the riveting of which pneumatic riveters were used, being supplied with power from air compressors on the grounds. One feature of the steel work, which is otherwise of the ordinary form, is the use of trussed purlins, which save about fifty per cent. of the weight of the material.

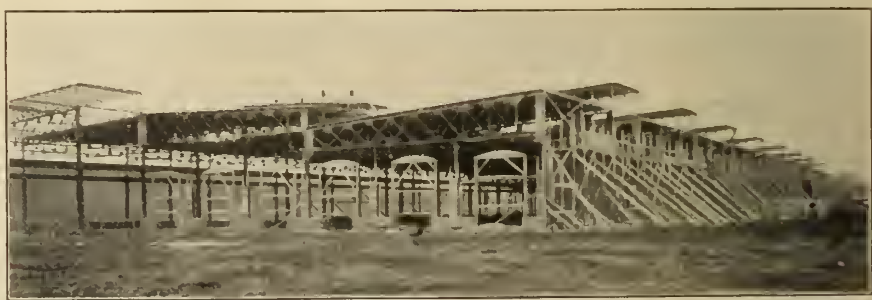
Machinery.

The general scheme of the machinery installation has been worked out, but the allocation of individual machines has not yet been decided. Electricity has been adopted for motive power and individual drive will be used wherever practicable, induction motors supplied with energy from the power house being installed. Electric cranes are being placed in all the buildings, and compressed air will be used wherever required.

Steam Turbines Adopted.

In keeping with other up-to-date methods employed by the firm to have a plant of the most modern type, it was decided to instal steam turbines in the power house and the Curtis turbines now being completed for the company will be the first of their kind to be operated in Canada.

The power house is built entirely of concrete, one hundred and fifty feet four inches long, by eighty-five feet wide, divided in the centre by a nine-inch concrete wall. At the north end is a hundred and fifty foot chimney of brick structure on concrete foundation. Six boilers, Babcock & Wilcox type, each of three hundred horse-power, with a working pressure of two hundred pounds per square inch have been installed in three batteries. These are provided with super-heaters to give a super-heat of one hundred and fifty degrees. Additional space has been allowed for two extra boilers. In the engine room, which is shown in cross section in the diagram, will be installed a complete generating plant consisting of two 500-k.w. turbo-generators, manufactured by the Canadian General Electric Co., and all the necessary auxiliary machinery for running the plant, either condensing or non-condensing. The system is designed so that in Winter the exhaust steam instead of being condensed will be used for heating the entire plant by direct radiation. The auxiliary machinery is supplied by the following firms: The con-



End View, Group 1—Canada Car Co.'s Plant.

densing plant and boiler feed pumps, by the Alberga Condenser Co., New York; the fire pumps, two in number, each of 1,000 gallons per minute capacity, by the Buffalo Steam Pump Co., Buffalo; the feed water heater of 2,000 h.p., and the centrifugal single stage turbo pump, also of 1,000 gallons per minute capacity, by the John McDougall Caledonia Iron Works; the step bearing pumps for supplying water at a pressure of 300 lbs. per square inch to the turbo-generators and the oil pumps, also for the generators, are supplied by the Canadian General Electric Co. There is also a cross compound Corliss air compressor for distributing air to the several buildings at 100 lbs. pressure per square inch, supplied by the Allis-Chalmers-Bullock, Limited.

The feature of the condensing plant is the ideal system of getting cooling water from the canal, which is several feet higher than the power house and circulating by gravity through the surface condenser and discharging into a large tank in the power house which has an overflow to a drainage canal, which also runs close to the power house. Thus the necessity of having circulating pumps is entirely done away with.

The centrifugal single stage pump discharges water into an elevated tank of 75,000 gallons' capacity, which supplies water to the sprinkler system and other fire protection arranged around the buildings, also supplying water for mill purposes. In the engine room there is a 10-ton traveling hand crane supplied by the Niles Co.

The plant, which is entirely self-contained, will manufacture everything from the raw material, lumber and steel. Its initial capacity will be about ten passenger cars per month and twenty freight cars per day, with their corresponding trucks. While wooden cars will be the first product, provision is being made to manufacture composite wood and steel, and all steel cars, pressed steel or structural shapes, street cars and special type of trucks and bolsters, and other specialties uned in car building.

Alternating Current Railway Motors.

(By K. McCaskill, M.Sc.)*

THE torque of an electric motor is produced by the action of a magnetic field upon current flowing in an armature which is moveable with respect to the field. If the field is excited by a constant current (a shunt motor on constant voltage), the speed is approximately constant and the torque is proportional to the current. When the field is excited by the main current we have a series motor. In this motor the field excitation increases with the load and the torque per ampere varies approximately at the current. The speed is inversely proportional to the current, except by the small amount it is varied by the saturation of the field. This latter motor is the direct-current motor which is in commercial use for traction work.

As the direct-current voltage for traction work is low, thus a large current to transmit any considerable amount of power is required; then a heavy current means large conductors and involves thereby heavy copper losses. In inter-urban traction service the cost of copper for feeders becomes so great that it is cheaper to install a sub-station every eight or ten miles. These sub-stations contain step-down transformers and rotary converters with the necessary equipment; the power being conveyed from the power house as high potential alternating current. Electrical engineers seeing the great saving in cost that would be made if the alternating current could be used on the motors have developed several different types of motors which possess the required characteristics.

If the current in both the field and the armature of a direct-current series motor is reversed the direction of rotation does not change. So that one would not expect to find any essential difference in the operation of the motor if the reversals were frequent. When alternating current is applied to a direct current series motor there is continuous rotation of the armature, but there are certain losses peculiar to alternating current that make the practical operation of these motors a most difficult

K. McCaskill, M.Sc.

problem. These losses in alternating-current motors can be considered as made up of the following:

I.—Iron losses:

(a) Due to reversals of magnetism in the armature and field owing to the alterations of the supply circuit.

(b) In the armature due to variations in magnetism dependent upon rotation of the armature.

(c) At the surface of the field and the armature due to the "bunching" of magnetic lines from the teeth of either.

II.—Losses in field windings.

III.—Losses in armature windings.

IV.—Brush losses.

V.—Friction and windage.

When giving reasons for the above losses and comparing them item by item with those in a direct-current motor, it is found that they include all those of the latter type along with the additional ones peculiar to alternating current. First:

(a) Iron losses due to the frequency of the supply circuit can be sub-divided into the following:

(1) Hysteresis loss.

(2) Eddy-current loss.

1.—In an alternating-current circuit surrounded by iron, energy is expended (outside the conductor) in the iron on account of the cyclic reversals of the magnetic flux in the field iron.

2.—The iron core being itself a conductor of electricity, secondary currents are induced in it. These currents flow in the mass of the iron in closed circuits approximately in a plane at right angles to the magnetic flux. The result is that the iron becomes heated and energy is dissipated. To reduce these eddy-current losses as much as possible the core should be laminated the same as the armature. No such loss exists in a direct-current motor as it is excited by continuous current. This loss in alternating-current motors will be a very small percentage of the total loss, unless the construction of the magnetic circuit is such as will allow a large eddy-current loss.

(b) Armature iron loss due to rotation of the armature in the field, depending on speed of rotation, induction

* Engineer in the Traction Department General Electric Co., Schenectady, N.Y.

in core, teeth, etc. This loss will be practically the same as a direct-current motor of the same capacity.

(c) Iron loss in the surface of the field and armature due to "bunching" of magnetic lines from the teeth. This loss will be similar to that of a direct-current motor except when the air gap is very small it will be least in the alternating-current motor.

Second:

The field-winding loss will be about the same as in direct-current practice, since the amount of copper will be practically equal in two motors of the same capacity.

Third:

The armature-winding loss will be similar to that of a continuous-current motor as far as the working current is concerned. A serious difficulty is the short-circuited current due to the transformer action which occurs between the field and armature. Let C D Fig. 1 be an armature coil in a bipolar machine at the position of commutation. Owing to the passage of alternating magnetic flux from one pole to the other, there will be a voltage induced in each of the various armature coils by transformer action entirely independent of their speed of rotation. This voltage will be different in the different coils, depending on their position, and will be a maximum in the coil C D which is at right angles to the flux and zero in the position A B. As each commutater bar passes under a brush an armature coil is momentarily short circuited.

The armature coils are thus short circuited consecutively in that position where the greatest e.m.f. due to the transformer action is induced in them. The result is an excessive current in each coil at the moment it is commutated, in much the same manner as results in an ordinary transformer having a short circuited coil. This current may be several times as great as the working current and would be disastrous to commutation, and also would be a source of excessive armature heating from the short circuited coils if means were not taken to prevent or reduce it.

Car Equipped with Series A C Motors, Voltage 2200.

Fourth:

Brush loss.—Alternating-current series motors are usually wound for a comparatively low voltage on the armature and thus greater brush capacity is required. In direct-current machines only two studs are used on a four-pole machine, while on a four-pole alternating-current motor four studs are used. Brush losses are thus increased, due to the greater number of brushes, in addition to the loss and deterioration of brushes caused by local currents in the brush due to the short-circuited coil.

Fifth:

Bearing and windage loss.—These are similar to a corresponding direct-current machine loss, but the brush friction loss will be greater, due to the increased number of brushes.

In all alternating-current motors the product of voltage and amperes (the apparent input) does not represent the true energy as a certain component of the input is required to magnetize the motor and to this must be added the magnetic leakage in the air gap, etc. So this wattless component must be taken from the apparent input leaving true energy of the motor from which the power factor is obtained.

Commercially there have been developed the following motors. They all possess the characteristics required for traction work:

I.—The series motor

1—Plain

2—Compensated directly (Eickemeyer).

3—Compensated indirectly (Lamme).

II.—Repulsion motor (Thomson).

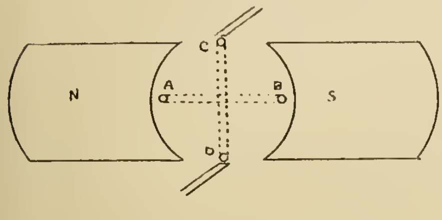
III.—Series Repulsion (Winter-Eichberg and Latour).

End of Test Car, Showing Bow Trolley.

First:

"The plain or uncompensated single-phase series motor is usually designed with definite field poles similar to the direct-current series motor, excepting the fact that the field is laminated.

In a straight series motor a certain



magnetizing current is required with a given field winding. In the design of this motor two voltages can be considered, viz., that across the field circuit and that across the armature circuit. The armature voltage can be made nearly non-inductive, so that the major portion of the input into the armature becomes true energy. Since the voltage across the field is at 90 degrees to the armature voltage and represents the wattless component supplied by the motor, the resultant of these two voltages will then be the line voltage.

The power factor when running is represented principally by the voltage across the armature winding being increased slightly by the losses in the field core and winding. Therefore, for high power factor it is important that the voltage across the armature circuit be made as high as possible in comparison with the line voltage.

To increase the voltage across the armature the following methods can be used:

I.—(1) Increasing the speed.

(2) Increasing the number of wires in series in the armature.

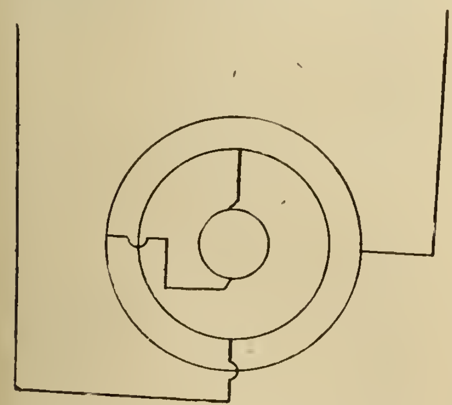


Fig. 2

II.—Increasing the induction through the armature.

First:

By increasing the speed, and an increase in the number of wires in series, the armature voltage will be raised without affecting the field voltage and, therefore, the ratio of armature voltage to line voltage is increased.

Second:

Increasing the induction in the armature also increases the induction in the magnetizing coil in the field, and the voltage of both are increased. Therefore this method will not improve the power factor.

Instead of increasing the armature voltage the voltage across the field winding may be decreased. This may be done in the following ways, viz.:

(1) Reducing the induction through the coil.

(2) Reducing the turns in the field.

First:

Reducing the induction through the field reduces the induction in the armature winding also, and therefore represents no gain.

Second:

The most feasible method of reducing the field voltage is reducing the number of turns; this can be accomplished in the following ways:

1.—By decreasing the effective length of air gap in the motor.

2.—By increasing cross section of the air gap.

(1) By making the gap very small the voltage across the field can be made very small compared with the armature voltage; this method is limited by practical reasons; for commercially it is found impracticable to have a small air gap.

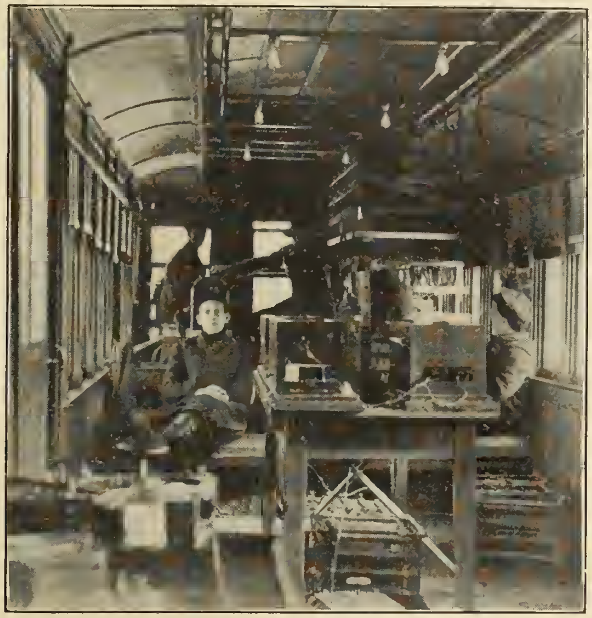
(2) Increasing the section of air gap without decreasing its length also improves the power factor but generally makes a larger and heavier machine.

From the above it is evident that the power factor of the straight series motor can be made fairly high, it being a question of proportion between armature and field; length of air gap and the amount of material used. In practice a compromise would naturally be made among the various characteristics and a slight reduction in power factor is probably of less importance than a corresponding reduction in size and weight with a large air gap.

In the characteristic curves of a plain series motor it will be seen that the speed is very high, the free running is between two and three times synchronism, the power factor increasing as the speed increases until it almost reaches unity. This seems strange as the wattless component of the field must still exist.

Compensated Series Motor.

Eichemeyer in 1890 found that it was possible to compensate for armature re-



Interior of Testing Car, 6000 Volts on Trolley.

action by surrounding the armature by a stationary circuit through which a current passes in the opposite direction to the current in the armature. This compensation more or less completely neutralizes the self-induction of the armature so that a higher ratio of armature reaction to field excitation is produced, thus better power factor can be obtained.

This can be most easily explained by the above diagram, Fig. 2, which can be divided into three parts as follows:

The field turns B C are called the compensating turns and can be considered as part of the armature, while the turns E F are called the exciting turns, and control the direction of rotation of the motor and strength of the field as in a straight series motor. The exciting turns represent from 20 to 25 per cent. of the whole number of turns in the field to have complete compensation, or when the ratio of compensating turns to the armature turns is 1 to 1.

By choosing the number of turns of

the compensating circuit, under compensation or over compensation can be obtained. Complete compensation gives the best results as shown.

The compensating series motor, then, contains exciting field turns in quadrature position to the armature circuit and compensating turns in line with the armature circuit. On account of the position of these coils in reference to each other, it can easily be seen that neither the armature nor the compensating winding can have any inductive effect on the exciting turns; that is, there is no mutual induction between the exciting turns and the other windings.

The field may be of definite polar design with small poles placed between these in series; this does not give as good compensation as a uniformly-distributed winding, since this latter would better neutralize the distributed armature winding.

The compensating circuit may be either energized by the main current in series with the armature or by a secondary current, by closing it upon itself in short circuit. When the latter method is used the compensation is always approximately complete, no matter if the turns are for over compensation or not.

In an over-compensated motor the sparking is reduced. The over compensation inserts a reverse e.m.f. into the coil short-circuited under the brushes. This is done at the expense of the power factor, which is somewhat reduced.

In the characteristic curves it will be seen that the power factor is high, being 80 per cent below half synchronous

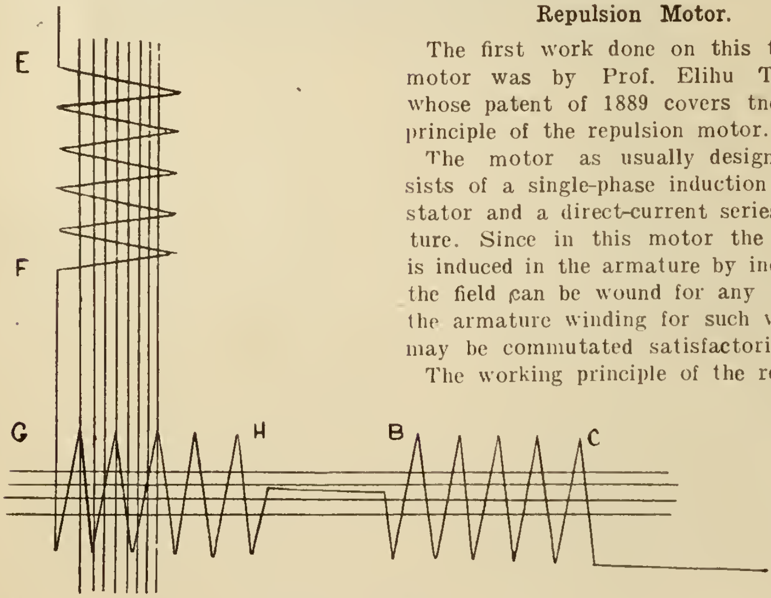


Fig 2.(a)

speed and gradually increasing to unity. The starting torque is very large, and with increase of speed the torque falls rapidly, similar to a direct series motor.

These motors will run with direct current. The directly compensated gives better commutation than a series motor designed for direct current; in fact, the commutation is so good that the volt-

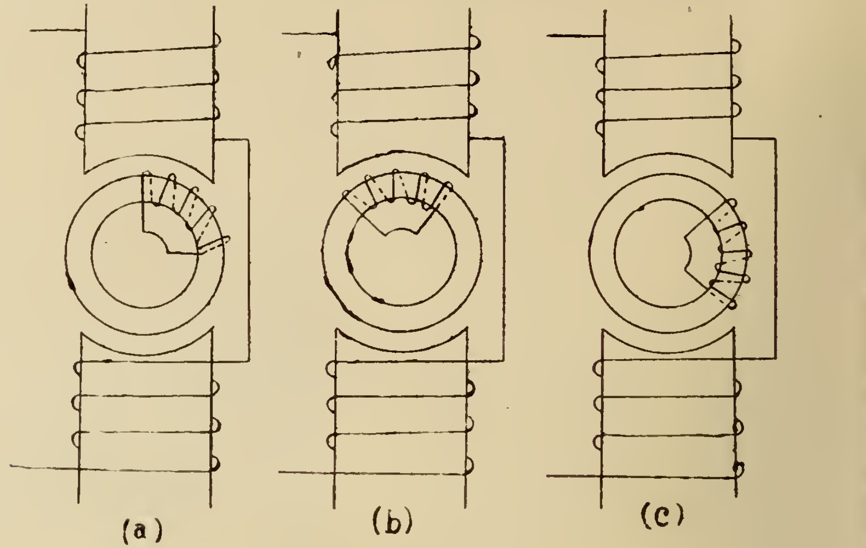


Fig 3.

age across the motor can be doubled without any danger of it arching over.

The compensated series motor is manufactured by two rival companies in America, and from facts which are given out by each company they seem to differ only in mechanical construction.

Since, with alternating current, it is possible to induce current from one circuit to another by induction, so taking the series motor it is possible to have current induced in the armature by short-circuiting the brushes.

Repulsion Motor.

The first work done on this type of motor was by Prof. Elihu Thomson whose patent of 1889 covers tne whole principle of the repulsion motor.

The motor as usually designed consists of a single-phase induction motor stator and a direct-current series armature. Since in this motor the current is induced in the armature by induction, the field can be wound for any voltage, the armature winding for such value as may be commutated satisfactorily.

The working principle of the repulsion motor may be most easily explained by the aid of Fig. 3, a, b, and c.

The two-pole magnet shown diagramatically is excited by means of an alternating current, and the short-circuited armature coil is consequently acted upon by an alternating flux. The induced alternating current is on account of self-induction of the coils about 90 degrees in phase behind its voltage, and since this voltage is 90 degrees in phase behind the flux, the induced armature current is approximately in phase with the flux. A pull is therefore extended in the direction of the arrow on those armature wires which lie under the

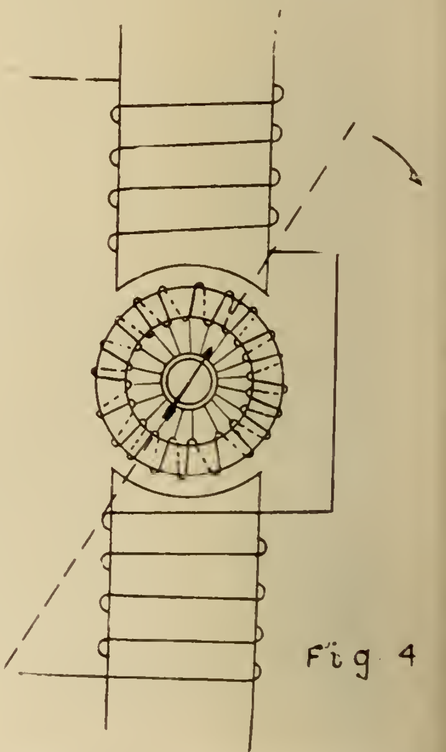


Fig 4

pole (Fig. 3 a). The tendency of the coil is to set itself in such a position that no current is induced in it, viz., (6). The current is a maximum in position (c), but there is no torque in

this position, as the wires under the two poles oppose one another.

In order to abtain a continuous torque a continuous armature winding must be used and arrangements made to maintain the relative position of the short-circuited eoils and the magnetic axis constant. For this purpose an ordinary continuous-current armature with a commutator can be employed. The brushes are permanently short-circuited and by shifting them the relative position of the short-circuited coils to the magnet axis can be altered at will.

In the above conditions the armature was assumed to be at rest; the armature current strength under the conditions is determined by the flux passing through the eoils and resistance and self-induction of these coils. When the armature starts to rotate the wires under the poles cut the flux; this induces a voltage which reduces the armature current so that with increased speed the armature current becomes less; as the speed increases the torque decreases until a speed is reached at which the armature current is just sufficient to produce the torque required to overcome friction. Thus we have similar characteristics to a direct-current series motor.

Electro Lifting Magnets

WHERE it is necessary to handle steel or iron in quantities by means of a crane, a magnet will effect economy in time and labor sufficient to pay for itself in from one to six months. This has been borne out by experience in steel mills, jobbing houses, safe works and other metal industries. Different illustrations are shown herewith of electro magnets, together with diagram of connections, embracing a line manufactured by the Electric Controller & Supply Co., Cleveland, Ohio.

In all cases an electro magnet is used, suspended from the hook of the crane; direct current at any of the common voltages being employed to energize the magnet. A flexible twin conductor cable is used to convey the current to the

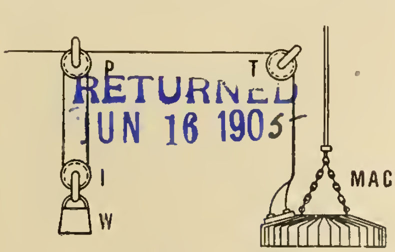
Magnet Lifting 11,000 lbs.

magnet and a small switch operated by the crane man is usually the only additional apparatus necessary. The amount of current used is small, being from one to twelve amperes according to the service for which the magnet is designed.

In operation, the magnet is lowered upon the material to be lifted, and the switch closed, thus causing the magnet

to attract and hold the material, which may then be hoisted by the crane and transported to the desired point. By simply opening the switch the material is instantly released.

Comparing this method of operation with the common methods of connecting the load to the hook of the crane with chains, hooks or clamps, the saving in both labor and time is appareat, as, in general, the attachment of the magnet to the load, as well as the release of the load, may be accomplished by the crane



Method of Wiring.

operator without assistance, thus saving the labor of one or more men for prying up the material, attaching hooks and chains at the point of loading and additional men at the point of delivery for unhooking the load from the crane.

Magnets can be so quickly attached to and detached from a load that by their use the work which may be done by a given crane is greatly increased, in some cases more than doubled. It frequently occurs that the attachment of lifting magnets to existing cranes so increases their capacity for handling material that the purchase of additional cranes for handling an increased output is rendered unnecessary.

Again, lifting magnets require much less headroom than hooks or chains for lifting material of considerable width, such as plates. Therefore, by the use of magnets, material can be conveniently piled to a greater height in the storage space under a given crane than is possible when chains are used, thus increasing the capacity of a given storage space without altering the crane runway or increasing the size of the building.

Lifting magnets may be used to great advantage in handling pig iron, scrap, rivets, bolts and similar articles in bulk, as shown in Figs. 1 and 2. Ingots, blooms, slabs, billets, bars, plates, rails,

Unloading Pig Iron.

structural shapes, pipe, etc., may also be handled to advantage; Fig. 3 being an example.

The Illinois Steel Co. uses fourteen

Magnet Handling Machine Boring.

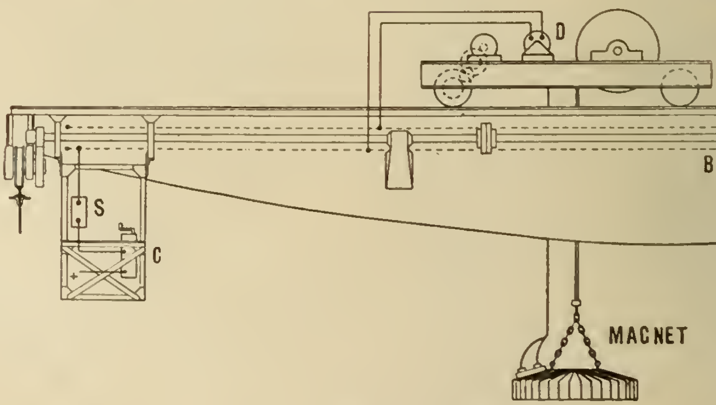
magnets in its South Chicago works alone, and has found the economy in time and labor so substantial that it has decided to use them wherever possible in all its works.

A single design of magnet is not adapted to handling the full range of material above mentioned; on the contrary, the magnet must in every case be designed to meet the form of material to be handled. For instance, there is a wide difference in the design of a magnet for lifting ingots or blooms and one adapted to the handling of thin plates. A magnet which would handle five tons in the form of an ingot might not handle five hundred pounds in the form of thin plates. It is therefore necessary to understand in each case the operating conditions with special reference to the form and range of material to be handled.

A small controller or switch for operating is conveniently mounted in the crane cab.

A drum "D" is mounted on the trolley and geared to a hoist shaft. A twin conductor flexible cable conveys the current to and from the magnet, the drum taking care of the slack. The cable is connected to a pair of contact rings on the drum and the current is conveyed from the controller in the cab to the drum chrough an extra trolley wire "B" and returned through the common return trolley wire "A."

In this case the twin conductor cable goes up through a pulley block "T," attached to the crane trolley; back to a block "P," attached to the girder near the cab; down through an idle block "I," and back through block "P" to the switch or controller in the cab. A weight "W" is attached to pulley "I" which rises and falls to take care of the slack cable required.



Method of Wiring

EXTENSIVE HEATING SYSTEM.

The magnitude of the Canadian Pacific Railway Co.'s new Angus shops, at Montreal, is plainly evident from the fact that no less than thirty-seven miles of steam piping was massed in the Sturtevant heaters which were installed in connection with the blower heating system.

Before a decision was reached a thorough comparative study was made of the different systems of shop heating by direct steam and hot water, and by blower methods. The latter was finally adopted as being the most efficient and economical where the requirements are so severe on account of the large spaces to be warmed, the high proportion of window area, and the low external temperature. The apparatus was built and installed by the B. F. Sturtevant Co., of Boston. Steam is distributed in tunnels to the different buildings from the central power-house, which is about 2,600 feet from the most distant part of the system. The buildings have a combined volume of about 26,000,000 cubic feet. From $\frac{1}{4}$ to $\frac{1}{2}$ of the wall surface is glazed, besides which there are skylights aggregating 25 per cent. of the roof surface. The specifications require most of the buildings to be heated to a constant temperature of 65 hegrees when the temperature outside is 10 degrees below zero. The radiation for this service is arranged at local points in vertical coils, with cast-iron bases, which are coupled up in groups. The fans, which draw the air through these heaters, are calculated to have an hourly capacity of the enormous volume of about 80,000,000 cubic feet, sufficient to completely change the air in every building once in about every 20 minutes. In very cold weather, however, a closed circulation will be maintained and the air returned to the heaters without receiving any access of cold air from outside.

In the planing mill the fan engine and heaters are located on platforms between the roof trusses. In most of the other buildings they are located in one or more separate lean-to brick annexes. Each set of heaters is supplied with both exhaust and live steam mains. In the locomotive and blacksmith shops the hot air from the heaters is distributed partly underground through brick conduits; but in the other buildings and in parts of these, the distribution system consists of cylindrical overhead galvanized iron ducts, supported on the lower chords of the roof trusses, having outlets through the vertical pipes carried down besides each of the interior columns. Practically no valuable floor space is occupied by the heating apparatus.

Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

INSTALLING ELECTRICAL MACHINERY.

In numerous instances manufacturing companies employ their own electrician and he is entrusted with the installation of the electrical machinery. The engine room, in most instances, is located in an addition to the main shops, or in a separate building. This necessitates the use of rigging, as the shop cranes are not available.

In Fig. 1, (a) represents a section of a generator foundation, (b) timbers laid across the foundation, (c) iron rollers, (d) and (d') wood blocking supporting the lower half of generator frame (e).

Generators of large size, for direct drive, are usually shipped in three parts. The upper and lower halves of field frame are blocked up on skids, and the armature is boxed.

Directions for assembling should come with the machine and should be carefully followed.

After the different parts are unloaded from the cars, the lower half of the machine is rolled upon the skids over the foundation, as shown in the figure.

Roof timbers in small engine-rooms are generally inadequate to stand the strains of erecting, and some substitute must be provided, such as a pair of large trestles similar to the one shown in Fig. 2. The size and weight of the trestles will, of course, depend on the size of the machinery to be erected.

The next operation is to place one of the trestles over the lower half of the frame, and with chain hoists lift it off the skids and lower it on to the foundation, as shown in Fig. 3.

The rope slings should pass around the frame and on either side of the field spools. The armature and engine shaft are hoisted on blocking and rolled over the lower part of the frame, as shown in Fig. 4. The armature is first lifted with a chain hoist and then pulled over on the blocking by means of rope tackle.

An armature blocked up ready for lowering is shown in Fig. 5, where (a) is the armature, (b) key for fly wheel, (c) crank disk and pin, (d) engine cylinder, (e) steam chest, (f) lower half of fly wheel, (g) engine bed, (h) front bearing, and (i) lower half of field frame.

Fig. 6 illustrates an armature, (a) being pressed on an engine shaft, the commutator is shown at (b), (c) is the hydraulic jack, (d) piston of the jack, (e) and (e') large arm straps held by connecting bolts, (f) and (f') wood blocking and (g) handle of jack.

After the armature and shaft are lowered into position, the upper half of the field frame is drawn up on blocking as shown in Fig. 7. With the trestles and chain hoists it is then placed as shown in Fig. 8. A piece of timber is laid across the trestles and a small tackle attached as shown. This is kept taut while lowering to prevent the fields from upsetting.

In some cases the upper and lower frame do not coincide. This is caused by the lower part of the field sagging. Placing a jack underneath and raising the frame at that point will spread it sufficiently to conform with the upper portion.

Pipes should be laid in the foundation for the cables that run to the switchboard. One pipe should be provided for each cable and have bushings.—Power.

THE USE OF INSTRUMENTS ON SWITCH-BOARDS.

The object of this paper was to invite discussion on the more important features of instrument engineering. It is evident that the conditions on a central-station switchboard will not permit of the same accuracy as could readily be obtained in a laboratory, and the information to be derived from the instrument readings does not require so exact a determination of values. For example, a shunt ammeter best adapted for laboratory conditions would have a shunt loss too great for switchboard service, and one designed for switchboards would have temperature errors so great that its use in the laboratory could not be contemplated. The author confined his notes to the conditions which are found on switchboards in central stations.

One of the most important considerations is in connection with the capacity of instruments to be used, and present needs cannot be altogether overshadowed by possibility of future growth. An ammeter whose needle constantly hovers around zero position is of comparatively little use, and an integrating wattmeter, which normally operates at ten per cent., and frequently at less than one per cent. of its rated capacity, may give a false impression of the operating efficiency of the station.

The friction of a jewel-bearing is generally considered so small that it may be neglected; but it must not be forgotten that a torque of 25 millimeter grammes is a little less than one five-thousandth of a foot-pound, and friction must be very small indeed if it is negligible as compared with this torque. Under normal working conditions, integrating instruments frequently operate at much lower torque, and even at full scale indicating instruments never approach this value.

It must also be remembered that the vibration of the board tends to impair the perfect polish of both jewel and pivot, and thus affect the accuracy of the readings. Other things being equal, it is apparent that these errors will be minimized by high torque, but they must not be altogether overlooked even under the most favorable conditions.

In deciding upon the capacity of an instrument it is necessary to take into consideration the relations between the smallest load, which it is desired to read, and the peak. It is generally considered advisable on railway circuits to have considerable overload capacity, and but little attention is paid to the light-load period. On lighting circuits, however, the overload is not considered to be as important as on railway circuits, and the light load is given more attention. It is usually good practice to select instruments of such capacity that under normal working conditions the needle of an indicating instrument will rest between half and two-thirds scale. This allows a reasonable capacity for growth and for overloads, and at the same time permits of sufficient accuracy during the light-load period.

Integrating instruments should be fully loaded under normal conditions, for they have an inherent overload capacity not possessed by indicating instruments; such practice insures not only low-load accuracy, but also a reasonable dial registration over comparatively short periods of time. Where hourly or even daily readings of the dial are recorded, it is not necessary that the registering train should have a capacity sufficient to care for several months' output. A rapidly-moving dial train permits full

advantage to be taken of the meter's accuracy, and a change of one or two figures should be recorded for each observation period.

Stray fields are always present in central stations and are frequently so strong that they cause marked instrument errors. In locating instruments on the board it is not sufficient to allow for position of bus-bars in relation to the instruments themselves, but the location of the iron framework of the board must also be taken into consideration. Magnetic fields have been carried by such iron frames and have introduced errors in instruments located many feet from the bus-bar itself. Such errors may be almost entirely eliminated by properly shielding the instrument, and no error need be introduced on account of residual magnetism or hysteresis of the iron shield.

The use of series transformers, even on circuits of comparatively low pressure, seems to be increasing; the added convenience in removing or in cutting out instruments for recalibration, and the added security for the operators, more than compensate for the slight errors introduced by their use. This practice is particularly to be recommended in those cases where both sides of the line are brought into the same instruments such for example as the polyphase, integrating, or indicating instruments. It is also a good practice to interconnect the stationary and moving circuits and case of indicating instruments, and very often this would hardly be practicable unless series and pressure transformers are used.

Commutator meters are the only ones available for measurement of direct current; properly equipped with cupped diamond jewels, and occasionally corrected for commutator friction, they give excellent results. But induction meters with light moving element and no commutator are to be preferred wherever their use is possible.

In the measurement of polyphase circuits, the greatest care should be taken to see that the instruments are installed exactly in accordance with instruments received from the manufacturer. Sometimes a slight deviation from the connection shown on the diagram to connections which seem to be equivalent introduces considerable error, due to the instrument coils being in wrong phases; instruments are not infrequently charged with errors which should properly be attributed to incorrect connections. —Read at meeting of American Institute Electrical Engineers.

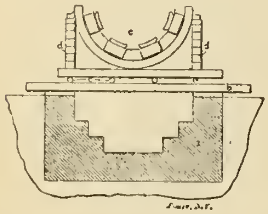


FIG. 1.

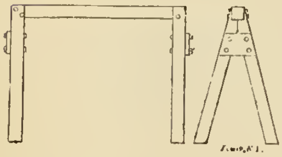


FIG. 2.

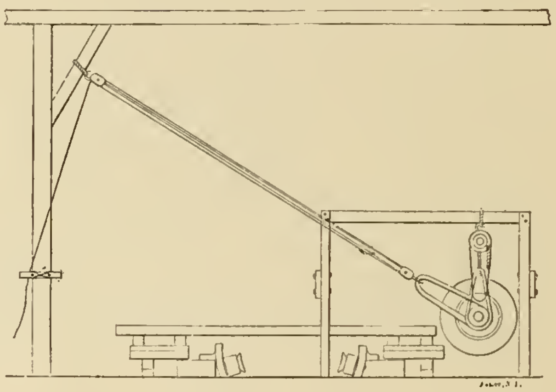


FIG. 4.

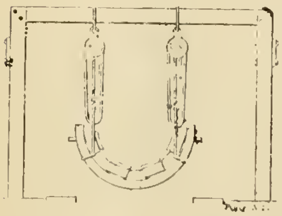


FIG. 3

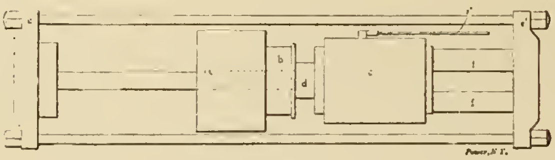


FIG. 6.

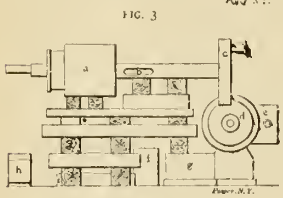


FIG. 5.

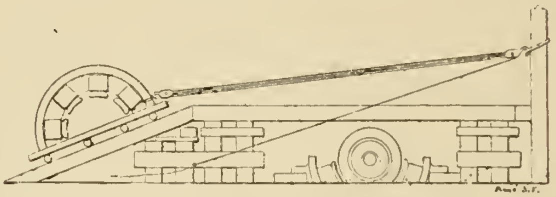


FIG 7

COMMERCIAL ELECTRICAL ENGINEERING.

"HE must understand more about the customer's business than the customer himself, and he must know more as to what the apparatus will do than the designer himself." Such was the reply of a man who was for a long time connected with the sales department of the electric company, when asked the principal qualifications essential in a commercial engineer. The man himself had handled many negotiations in which the engineering features were of great importance and he had, moreover, been in a position to observe the work of others.

The engineering work of a large electric company may be divided under two general heads; the first is the design of apparatus and the issuing of specifications and data describing what it will do; the second is the selection and application of the apparatus to specific cases.

The latter, which may be termed commercial engineering, is sometimes quite a simple matter; in other cases it is of the greatest difficulty and calls for the highest grade of engineering ability. It is not so much a knowledge of the theoretical elements involved in the design of the apparatus, a motor, for example, which is needed, as a good practical knowledge of what the motor can do. This practical knowledge needs to be based upon a definite knowledge of what the motor can do on shop test, and upon good judgment—based upon experience—in the selection of a definite motor to meet the requirements under particular conditions which may be uncertain and indefinite and varying in character, an estimate which is very hard to express in amperes or horsepower.

But why should an electrical engineer or an electrical salesman know the customer's business, too? Electrical work is seldom purely electrical. Electricity is simply an agent. It enters into other things as a means of accomplishing results. Hence, it enters into them vitally and intimately. Every department of a railway or a factory which adopts electricity may in one way or another be modified by it. Electrical engineering is related to all other kinds of engineering, steam, hydraulic, pneumatic, mechanical, civil, chemical. In order that the commercial engineer may effectively apply his apparatus and show that it can produce results, he must be thoroughly familiar with the business of which his electrical machinery is to form a part, and which perchance it is to modify or revolutionize. Hence, the need of a fundamental, all-round, common-sense knowledge of all kinds of engineering and all kinds of operation. Hence, the education of the engineer should not be a mere collection of facts, but a development of engineering faculties. The education of the electrical engineer in college and in the apprenticeship course should lay a foundation in the fundamental principles of differ-

ent branches of engineering and in a training which will enable these general principles and general knowledge to be correctly applied in particular cases. In no branch of engineering is a broad general knowledge and the ability to apply and use such knowledge for specific purposes more necessary than in electrical engineering.—Chas. F. Scott, in Electric Club Journal.

TO USE OLD DRY ELECTRIC CELLS.

THE cells of exhausted dry batteries will make good Grenet cells, if the bottoms are cut off and the filling and paper lining, if any, are removed. Be careful not to break off the carbon rod.

After the filling has been removed, if there is a paper lining, it may be removed as follows: Drill an exhaust hole through the cement in the top of the cell, then stand the cell in a watertight receptacle and fill the receptacle with water to within ¼ in. of the top edge of the cylinder. Let it stand until the paper lining is loosened and may be entirely removed.

The electrolyte to be used is 7 oz. of bichromate of sodium dissolved in 1 qt. of water. Add, very slowly, 1-3 pt. strong sulphuric acid, stirring the mixture slowly with a glass rod all the while. When the mixture is cool pour it into a glass battery jar and add 1 oz. bisulphate of mercury, which will amalgamate and keep amalgamated the zinc cylinder. The solution should be sufficient in quantity to extend up the zinc cylinder for three-fourths of its height. When not in use take the cylinder out of the solution.

If while working with the batteries any of the acid or the solution should get on the hands or clothes, rinse off immediately with clean water.—Popular Mechanics.

HEATING BY FRICTION.

A St. Joseph, Mo., negro has made an invention which has been put in use, and it has been demonstrated that it will produce enough heat to warm the largest building in the city in the coldest weather without the use of coal or wood. The heat is produced by friction. The invention consists of a steel tube surrounded by a jacket, and inside of the tube a wooden roller cut into four triangular sections and arranged about a steel shaft. A water chamber outside of the tube is ten inches in diameter.

A two-horse-power motor is used to operate the machine, and tests have shown that at a speed of 700 revolutions it will heat 990 gallons of water to a temperature of 160 degrees in fifty-four minutes. At 700 revolutions steam is produced in five minutes from the time the machine is started. From that time on there is a gain of ten pounds of steam every three minutes. It has been shown that the machine will produce the wonderful gain of 200 pounds of steam an hour.

A NEW CADMIUM LAMP.

A NEW cadmium lamp has been recently invented in Germany, and offers considerable interest, at least from a theoretical standpoint. Some seven years ago, Gumlich made a lamp using cadmium and mercury, and the light contained the very brilliant rays of the cadmium spectrum superposed upon the mercury rays. The lamp did not last long, however, as the globe broke very soon. At present two experimenters, O. Lummur and E. Gehrcke, have taken up the question. Their new lamp is shown in the diagram.—Scientific American.

HEATING IRON IN COLD WATER.

IT would now seem as though the common, but time-honored blacksmith's forge, and all other kinds of fiery furnaces will become extinct and live only in the memory of a rapidly

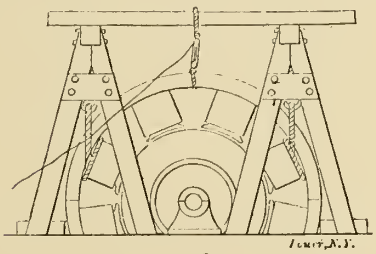


FIG. 8.

receding past. The forge and furnace of the future will consist of a lead-lined glass or porcelain vase or cupola filled with acidified water, to which is connected a strong positive conductor. A pair of tongs with insulated handles attached to a flexible negative conductor are also provided, making the new forge and outfit complete. The smith seizes the piece of iron he wishes to manipulate with the insulated tongs and plunges it into the sour water, which begins to boil and bubble the instant it comes in contact with the iron, which, in a remarkably short space of time, turns to a red and then to a white heat ready for the work of the smith. So rapidly is the heating done that the water and the portion of the iron not immersed in the water is but slightly warmed. The principle involved in this process is the same as in incandescent electric light. Resistance produces the light and heat. It is said that enormous heat can be produced by the method, much greater than is necessary to extract the iron from the most refractory ores. Like all, or nearly all, of the late practical applications of electricity, this discovery will no doubt lead to marvellous results in the perfect and rapid handling of heavy iron and steel plates and bars that have to be hammered and welded; and more valuable still for tempering purposes as the required heat for the immersed portion can be quickly obtained while the remaining portion is kept comparatively cool, which cannot be done by present methods. By electricity we live and move, and by electricity some of us die. —Science and Art of Mining.

SIMPLE WELSBACH LAMP.

QUITE recently there has been introduced in France and Germany a new form of portable lamp, as compact and light as an ordinary kerosene lamp and more easily operated, which has for a fuel supply wood alcohol.

The burner, as compact as the usual kerosene burner, and adapted to fit any regular fount, is of a novel regenerative type, to which the wood alcohol is conducted by a wick. The latter needs no trimming, as the alcohol by the heat is gasified, and then being mixed with air, produces an intense flameless heat above, which renders brilliantly incandescent the usual netted Welsbach mantle, suspended from above and inclosed in a cylindrical slender glass chimney similar to the student lamp type.

This gives in very small compass an intense illumination, equal to forty-five candle-power with the small mantle, and a smokeless light of remarkable steadiness and brilliancy, and which can be perfectly regulated, with the advantage of being odorless even when lowered to bare incandescence.

One of the points of novelty is an automatic device for feeding a minute quantity of alcohol from the fount to the burner in starting, which is done much in the same way as the usual mechanical extinguishing devices are operated on kerosene lamps. The small amount of alcohol thus brought up is simply ignited by a match, as in an ordinary lamp. In about a minute the light burns brilliantly.

On the continent, where alcohol is made cheaply, a source of illumination is produced fully as economical as kerosene, and much more easily handled.

It has been stated that in this country it is possible to produce wood alcohol more economically than in Europe, because of our large forests, which form an abundant source of supply of wood.

As a light for photographic and projection purposes, it becomes very efficient, inexpensive, and convenient.—Scientific American.

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

LOCATION AND CARE OF STEAM GAUGES.

As principles which cause steam gauges to give correct results are not always understood by men who have charge of them, the following illustrations and explanations taken from everyday practice will doubtless be of interest.

Fig. 1 shows a method of connecting

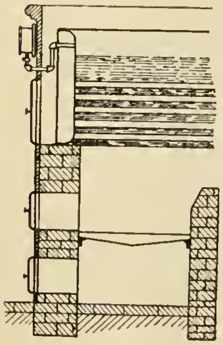


Fig. 1

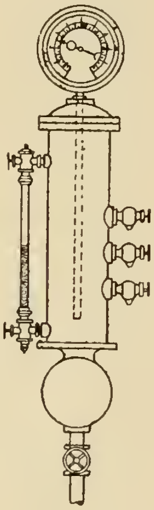


Fig. 3

gauges adopted by a firm that turns out hundreds of good tubular boilers. A $\frac{1}{4}$-inch pipe is connected into the front head above the water line. A loop is formed by nipples and ells, which causes water to stand in this pipe, thus protecting the gauge from the heat of the steam.

This method of connection works fairly well when the boiler is under a light load, but when the boiler is worked to its full capacity this little pipe is in the midst of hot gases on their way to the

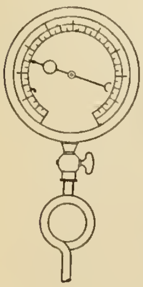


Fig. 2

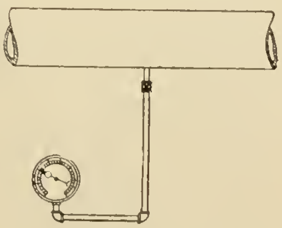


Fig. 4

chimney, which heat it, and probably evaporate the water in the loop.

To avoid this possible danger, these pipes may be taken out of the boiler and located in plain sight. Each loop is connected into another pipe without a valve between this connection and the steam space of boiler, although a valve may be placed in the small pipe near the connection. It is customary to locate a double-ended pet cock under the gauge in such a case, but it is omitted here, therefore leaks from the source do not annoy the fireman by dropping water on the furnace doors.

A union is located at this point so that when the pipe needs cleaning the $\frac{1}{4}$-inch valve is closed, the union disconnected and the valve opened under a full head of steam, thus blowing out all sediment. After this the pipe is allowed to cool; then the union is connected and steam turned on. Enough steam is condensed to protect the gauge. Where a pet cock is provided in a connecting pipe it is customary in some plants to draw the water out of this pipe frequently without shutting off the gauge, but this is wrong, because heat thus admitted to the spring injures it. Brass pipe should be used for such service as it does not corrode as quickly as iron pipe.

The siphon shown in Fig. 2 keeps water in the pipe at all times, but it has a disadvantage in that there is no provision made for cleaning it without disconnecting the gauge. Water cannot be drained out so that if the gauge is located in an exposed position the water is liable to freeze in cold weather, thus preventing the gauge from indicating correct uressure. Accidents have happened from this cause in the past, and probably will in the future.

Fig. 3 shows another plan for protecting a gauge. Under normal conditions this gives good results; but when the lower drip valve is opened to blow sediment out of the column the end of the connecting pipe, shown in dotted lines, is above the water line, so that steam is admitted to the gauge, endangering the spring.

The supposition that a good gauge will always correctly indicate the boiler pressure, regardless of the way in which it is connected, is erroneous, as the following illustrations will show.

Fig. 4 represents a low-pressure gauge attached to a steam-heating main. A column of water always stands in this pipe, and the vertical distance from the centre of the gauge to the top of this water is 8 feet 4 inches. The actual pressure at this point, without steam in the main pipe, is 3.6 pounds, due to the weight of the water. The dial of this gauge is graduated into pounds, so that the indicator should stand at about three-quarters of the distance between 3 and 4 pounds, when no steam is in the mains. When reading the pressure on this heating main, this amount should be subtracted from the pressure the gauge indicates.

Fig. 5 illustrates a gauge located on the floor above the boiler room. If a gauge so placed is piped so that all water drains back into the boiler, it

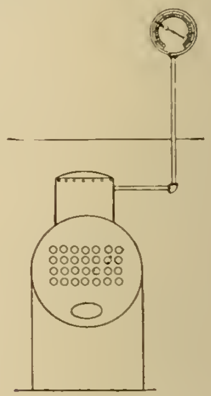


Fig. 5

will indicate correctly; but if the connecting pipe contains water, the gauge will indicate one pound less than correct steam pressure for each 27.7 inches vertical height of water. In other words, the result will be directly opposite to that obtained with the arrangement shown in Fig. 4, although both gauges may be correct.

Fig. 6 shows a steam gauge attached to a Manning boiler. It is connected into the shell just above the crown sheet, consequently the weight of water above the gauge creates a pressure

Fig. 6

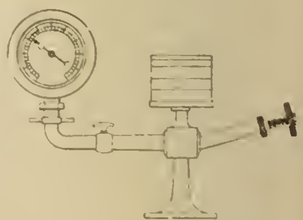


Fig. 7

which must be subtracted from the indicated pressure to obtain the true head of steam carried.

In a plant where this kind of boiler is

in use, the inspector objected to the pressure carried, as it was more than five pounds above the limit fixed. The engineer claimed that he was allowed to carry a certain steam pressure, and that the water as above described was responsible for the surplus pressure indicated. Now, the safe working pressure of a boiler as fixed by an insurance company is based on the estimated strength of the shell, heads and tubes; consequently the limit should not be exceeded, regardless of what causes said pressure. If a gauge located as shown in Fig. 6 shows 100 pounds, ten of which are due to weight of water, it is the same as if 100 pounds of steam were carried on a horizontal boiler, or one of the water tube type where the height of water is not enough to make much difference, therefore the gauge should never show more than the amount allowed.

Of course the ruling gives less available pressure for a vertical than for a horizontal boiler, and the difference is enough in many cases to seriously affect the engines using steam, but it keeps one on the safe side, which is a very important point.

Although a steam gauge may be correct when new, it does not necessarily follow that it will remain so, therefore every gauge should be tested at least once a year. This does not mean that in a plant where a score or more are in use, each one should be disconnected and tested separately, as that plan would make much unnecessary work. If a certain gauge is tested each year, and all others indicate similar pressure, where they are connected in the same way, no further proof of their accuracy is needed. Where they are connected in different ways and indicate different pressures, if they maintain the same difference towards the one tested, it shows that no change has taken place in them, and this is sufficient proof of their condition.

Fib. 7 illustrates an instrument for testing gauges. The body is partly filled with oil and a small plunger inserted. This carries with it a circular platform upon which the desired number of weights are placed. Five are shown in the illustration, the three bottom ones indicate 20 pounds each, the next indicates 10, and the top one 5 pounds' pressure to the square inch; consequently, when the adjusting handle is screwed inward, so as to just float the tightly-fitting plunger in the oil, the pointer will indicate 75 pounds if all parts are properly adjusted.—American Electrician.

THE TWO-CYCLE GAS ENGINE.

It is a fact that up to the present time the field of usefulness for the two-cycle engine is largely confined to light power marine purposes; principally to small pleasure boats. Here it has gained considerable favor; so much so in fact that it has claimed for itself a large share of the field; I have never been able to assign any good reason, at least not a satisfactory one, just why it remains so closely confined to this particular branch of the gas engine industry. Yet the manufacturers of it are confining themselves principally to the boat industry and seeking its market there instead of branching out into the open field and advocating its general usefulness. The four-cycle engine being the first in the field, and really the only active one for a number of years in advance of the two-cycle, it naturally gained quite a lead in the industry in general. It would appear that the "great world of people" is made up of ninety-nine per cent. of imitators and one per cent. of real, actual, original thinkers. The imitators are very active in proclaiming to the general public their wonderful products, while the thinker is modest and is so busily engaged in thinking that it leaves him little time to proclaim his discoveries from the housetops. When the "original thinker" first set in motion the four-cycle gas engine and demonstrated its success, there were ninety-nine imitators ready to take up his ideas and push them before the public as their own, in so many different "makes" of gas engines. Different only in name and minor construction; but all embodying the same general principles set forth by the "original thinker." After these ninety-nine imitations and one original four-cycle engine has been before the public for a number of years, another original thinker brings out the brilliant two-cycle idea and actually demonstrates its success; perhaps in propelling a little boat. His imitators are there, ready, but so also are the four-cycle fellows ready, to apply their power with his propelling principle, and to share and divide up with him the field he has selected. Consequently he, with his imitators, has a hard time of it. Their product, no matter how much merit it may possess, is comparatively slow of recognition, by reason of the deafening noise made by the continuous bombardment of the larger and more numerous four-cycle guns and the active imitation advocates. This seems to me to illustrate one of the reasons at least why the two-cycle engine occupies a small corner at this time.

Advantages.

The advantage of simplicity alone will go far toward establishing the general recognition of the two-cycle engine. It has proven itself efficient, with power development and running qualities equal to those of the four-cycle engine. Its success in the marine field ought to convince the most skeptical that, if given the right kind of an opportunity, it will be able to withstand successfully the severest tests in the general field. Especially do we believe this is true in reference to the smaller-sized engines. The experience with it in heavy power engines has not been extended enough to demonstrate its practical efficiency in comparison with the four-cycle. We apprehend a difficulty in getting rid of the extreme heat. In the four-cycle engine we have the advantage of the intervening idle stroke which allows double time for radiation. But in the two-cycle the continual successive explosions at each outward stroke of the piston will create a heat in large cylinder areas that will quickly injure the piston and cylinder walls unless vigorously met with an efficient cooling proposition.

In very large cylinders the difficulty of an unequal expansion and contraction looms up, which is even more tedious to overcome than the getting rid of high temperatures or maintaining them below the danger point. This is a difficulty that is not noticeable in cylinders of small dimensions; but it is a matter worthy of much consideration by those who contemplate the building or purchasing of engines with cylinders of extremely large dimensions, whether of two of four-cycle type; the advantage on this point being in favor of the four-cycle. We are of the opinion that this difficulty will be met by constructing engines of large power capacity with multiple cylinders of small dimensions.

Coming More in Use.

We see no reason why the time is not ripe for the two-cycle engine to "move out into society," and become generally known. It has the qualifications to become a leader. If properly constructed it is capable of developing more power from the same cylinder area than the four-cycle. Consequently its construction will admit of less weight in equal power capacity than the four-cycle. It can be made to develop as much power from an equal amount of fuel as the four-cycle. In simplicity of construction it is so far ahead of its elder brother that there is really no room left for comparison. You can imagine how simple the four-cycle engine would look if it were constructed without valves, valve cams and rollers and the rods and gears necessary to operate them. This is exactly what is done in the two-cycle engine. Simplicity in the construction of the gas engine is a very desirable modification. The appearance of the two-cycle engine without valves and their necessary mechanism, does away with what might be called a lot of "clap trap," that requires constant care and causes an endless amount of trouble in the four-cycle engine. In us-

ing the word "clap trap" in connection with valves and their mechanism we do it advisedly. A well-constructed valve is mechanical, and not "trappy," and works harmoniously with the movements of the machinery to which it is attached. But if the same results can be attained without this valve mechanism, then it becomes superfluous, unnecessary, and in a sense "clap trap." Excellent running qualities, economical fuel consumption, efficiency in power development, coupled with extreme simplicity, when compared with the four-cycle, are the advantages that the two-cycle engine possesses to recommend it to the careful consideration of the general power user.—The Threshermen's Review.

MAXIM ON FLYING MACHINES.

SOME plain common sense upon the flying machine problem and an interesting prophecy are contained in an article published by Sir Hiram Maxim. After pointing out that Santos Dumont has gone about as far as it is possible to go in navigating the air by means of dirigible balloons, the writer says:

"This one thing is certain: If we are ever to fly, we must imitate Nature—and nature has no balloons. The innumerable flying machines of Nature all depend upon dynamic energy, and upon dynamic energy alone, to raise them from the ground and propel them through the air.

"In my own experiments I have been able to lift a weight of 10,000 lbs. by the motor propelled aeroplane. Once in the air the chief difficulties to be overcome lie in two words—stability and steering. The last should present no great trouble, but the first mentioned is a serious, though by no means a hopeless problem.

"The aeroplane experimenter has a practical study ever presented to him by Nature in the birds. The mystery of the hovering bird is explained by the fact that in the atmosphere there are little ascending currents of air, into one of which the bird flys and stays. His weight may be dragging him down at two miles an hour, but if the current is also rising at a pace of two miles the fall is neutralized.

"Again, most of us have watched a gull following in the wake of a ship without apparent exertion. The reason is that the bird has fixed on the exact spot in the air wake of the ship, corresponding to the sea wake below, where the rush of air bubbles up, and not only holds him in his place, but carried him on. If the gull turns aside to pick up a piece of food, he has to fly very hard until he gets back to his effective position.

"The aeroplane can never have the air instinct of a gull or hawk. It resembles more closely a wild duck.

"The duck has of necessity to be strong, for he neglects the air currents and drives straight forward by the power of his wings and breast muscles. The aeroplane is the duck of the air.

"The original formulae reasoned out by Newton and other mathematicians of past generations were extremely unfavorable and discouraging to experimenters with aeroplanes. Recent experiments, however, have demonstrated that these formulae are very wide of the truth, and that the lifting effect produced by propelling an aeroplane through the air at a high velocity, and at a very slight angle above the horizontal, is many times as effective as it was supposed to be by the older generation.

"I have recently made some experiments myself at the Crystal Palace with an apparatus much more suitable for the purpose than ever has been used before, and I find that there is no doubt on this point. If a well-made aeroplane, placed at a very slight angle above the horizontal, is driven through the air at a very high velocity, the lifting effect is about a hundred times as great as it would appear to be by the old formula. Lord Rayleigh conducted some very interesting experiments a few years ago to demonstrate this ancient error.

"Now that we know that an aeroplane will lift much more than was originally expected and as the manufacturers of and experimenters with motor cars have already developed a very efficient motor with amazing power in proportion to its weight, it would appear that the motor and the corrected formula may solve the problem. It remains a question, as Lord Rayleigh put it, of 'a lot of time and a lot of money.'

"The future aeroplane will not be a thing of the cities until such times as all overhead wires are under ground.

SUCTION GAS PRODUCERS.

IN Europe, where fuel conditions are much more serious than in this country, engineers have been designing gas plants running as low as five horse-power for a number of years.

Some years ago a very noted French engineer, in studying the conditions in small individual power plants, gas engines and gas producers, noticed the fact that the gas engine itself, as it is at present constructed, depended upon suction for its supply of explosive mixture. This caused him to try the experiment of running a gas producer without a blower or exhauster and gas holder, and to his gratification the experiments were entirely successful.

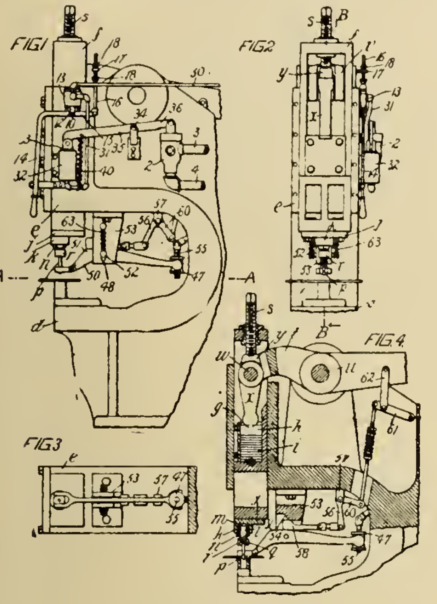
This has led to the adoption of a style of gas-producing machine called a "suction gas producer" which, in its physical and chemical properties, is in no way different from any other producer, but is so designed that the gas engine makes indirectly the required amount of gas for its consumption. This does away with gas holders and produces power directly from the coal at a cost far below what could possibly be obtained in any other way.

It is this type of apparatus with which we have to deal and we will give a short description of the principles involved, of the operation and care necessary in operating these plants and peculiarities in the design of the various types of machines of this kind.

It is a well-known chemical fact that if air is passed through a bed of incandescent carbon the oxygen will combine with the carbon to form a gas. This gas, if it is completely burned to CO_2 has no value. If, however, this gas is passed through a further bed of carbon, by the affinity of carbon, we reduce the products to another composition containing one part of carbon to one of oxygen, CO. In combining with this further quantity of oxygen and burning, we give off heat which is energy and which may be put to useful work. This is the foundation of the theory of all forms of gas production. We obtain this gas by passing air through an incandescent bed of carbon, but we can only use the oxygen in the air, and for each unit of oxygen required we must by volume have four units of nitrogen present, air being composed of one-fifth oxygen and four-fifths nitrogen, we get a gas composed of about 80 per cent. nitrogen and 20 per cent. CO. This would be what is called a "weak" gas, as the nitrogen has no value in heat or heat energy. Various means are, therefore, employed to reduce the quantity of nitrogen in the gas, the cheapest method being to disintegrate steam, which is composed of two parts hydrogen and one of oxygen, the hydrogen separating from the oxygen owing to the latter's affinity for carbon, when steam is passed through a bed of live fuel. The hydrogen remains in the gas and is of value, and the quantity of air necessary is much reduced by the addition of the free oxygen. In this way we arrive at a gas containing approximately 20 per cent. CO gas, 15 per cent. hydrogen and 65 per cent. nitrogen, this gas being much richer than the gas previously described. All this is on the assumption that we are using pure carbon; but, unfortunately, for commercial purposes we are obliged to use coal, charcoal or other carboniferous fuels which contain, besides carbon, hydrogen, nitrogen, oxygen, sulphur, silica, slate and other ingredients. Those of value for the production of gas are, of course, merely the carbon and its combinations with hydrogen and oxygen.—Power.

Recent Canadian Patents

HERETOFORE it has been impossible to publish illustrations and descriptions of Canadian patents owing to the fact that these are not printed by our Patent Office. To get over the difficulty it was necessary to obtain these

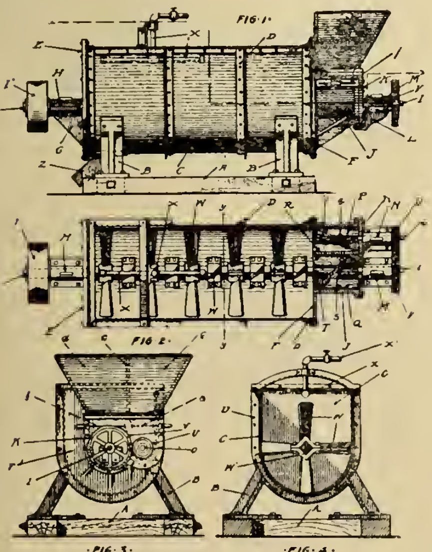


Punch.

patents from the United States Patent Office as issued to Canadians. For these presented herewith Canadian Machinery is indebted to the firm of Fetherstonhaugh & Co., patent barristers, solicitors and experts.

Punch.

Patent No. 787052, issued to William Ross, of Montreal. The invention re-

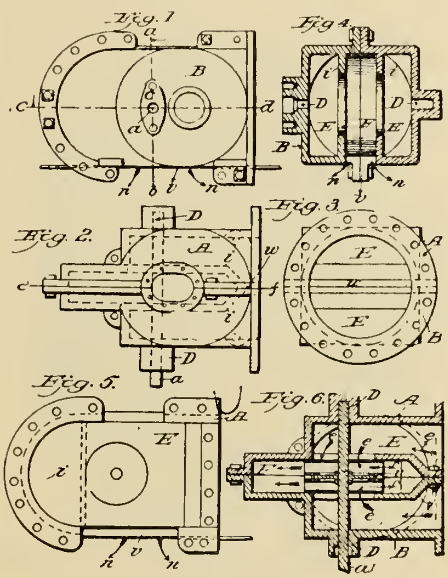


Cement Mixer.

lates particularly to the power punches in use for punching heavy work, and it has for its object to enable a punching tool of any length to be used, the stroke of the punch to be varied, and to improve the means for stripping the work being punched from the tool.

Figure 1 is a side elevation of a power punch constructed according to this invention. Figure 2 is a front elevation with the face plate removed. Figure 3 is a horizontal sectional view taken on line AA., figure 1, and illustrating particularly the combined work retainer and stripper and figure 4 is a longitudinal vertical sectional view taken on line DD., figure 2.

The frame of the improved punch comprises a work supporting portion (d), and a guiding head (e) for the reciprocating tool carrier. The reciprocal tool carrier slides in the guiding head (e) and consists of an open rectangular frame (f), having the lower end of its opening contracted to form a receptacle (g) for a

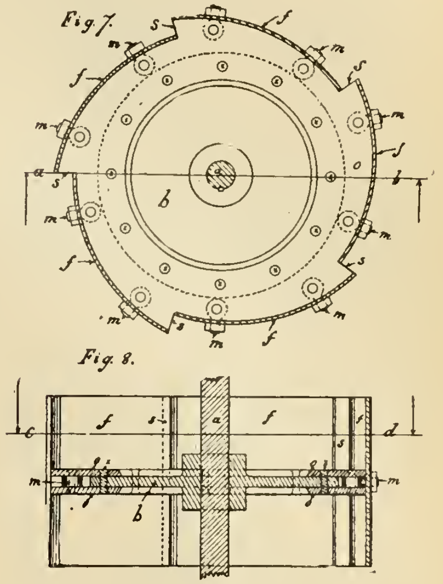


Turbine Water Wheel.

bearing block (h), and a series of fillers (i). The tool (p), which may be of any length, is held rigidly upon the end of this bolt by a perforated interiorly screw threaded cap (r). The upper end of the frame is formed in a capped opening, in which a screw bolt (f) is threaded. This carrier frame is caused to reciprocate in its guiding-head by a lever (t), fulcrumed for the frame of the machine. When the working tool is set in place the filler-blocks are removed, thus allowing the carrier frame to be raised independent of the pitman-bar (x), until the working end of the tool is, when the machine is at rest, at its proper distance from the work support.

Cement Mixer.

Patent No. 787071, issued to Charles Brent Rat Portage. This inventon relates to a useful improvement in cement mixers, particularly in the construction, arrangement and combination of parts. In the drawings, figure 1 is a side elevation of the improved mixer. Figure 2 is



Turbine Water Wheel.

a horizontal section on line xx figure 1. Figure 3 is an end elevation looking from the right hand end of figure 1. Figure 4 is a vertical cross section upon line yy figure 2. What is claimed in this invention is the combination of a mixing chamber, the end plate F at one end, the sand

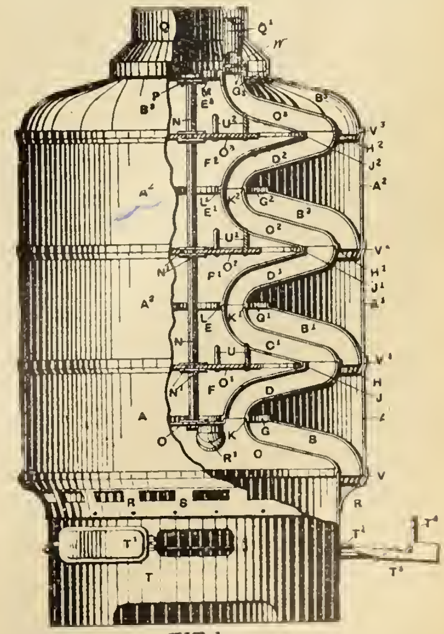
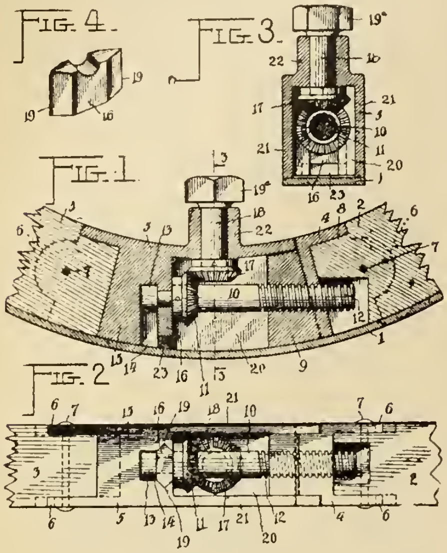


FIG.1.

Gas Heater.

chambers Q, the shaft I, extending centrally through the mixing chamber and centrally through the sand chamber, bearings at the end of said shaft, a bear-

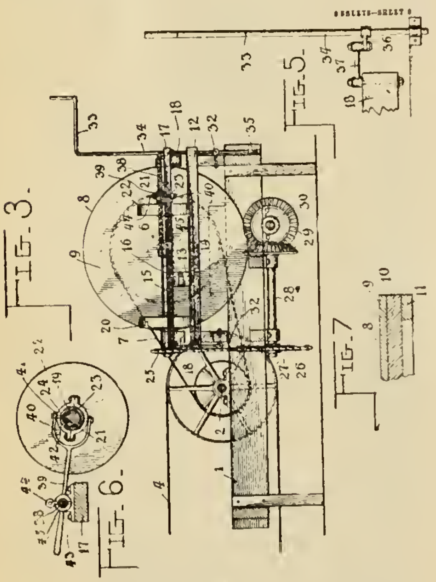
ing at the end of the cement chamber, shaft O in their bearing, the worm (b), the worm (T) of the main shaft, the beaters or blades W on the main shaft within the mixing chamber and the intermeshing gears on shafts I and O for the purpose described.



Felly Tire Set.

Turbine Water-Wheel.

Patent No. 786617, issued to Clarence O. Anthony, Kennetcook Corners, Canada. The invention relates to that class of turbine in which the water enters axially and is discharged tangentially at the circumference, and the objects of the invention are to produce a cheaper, more powerful and more economical wheel than any now in use. Figure 1 is a



Feeding Mechanism for Saw Mills.

side elevation of the case enclosing the wheel. Figure 2 is a plan of the same. Figure 3 is an elevation of the right-hand end, showing the intake and the position of the conduit-coupling bolt. Figure 4 is a section of the case on line (ab) of figure 1. Figure 5 is an interior elevation of the case with one section removed. Figure 6 is a section on line (cd) of figure 1, with the wheel in position. Figure 7 is an elevation of the wheel in section on an enlarged scale, on line (cd) of figure 8. Figure 8 is a section on line (ab) of figure 7. The claims in this patent are in a water-wheel, a disc secured to a staff at right angles thereto, two forming-rings each having corresponding eccentric serrations in its periphery and attached one to each of the disc with their serrations projecting beyond its circumference, eye-bolts secured in the space between the forming-rings, and blade set at right angles to the disc.

Gas Heater.

Patent No. 786300, issued to E. Laberge, Montreal. Figure 1 is a general upright view of this invention, being shown partly in sections. The invention relates to an improvement in stoves or furnaces of what are known as the "hot air" type, in which the air is circulated over and between heated surfaces, and when at the desired temperature is discharged through suitable conduit-flues into the rooms or other chambers which are to be heated. It relates, however, more particularly to gas stoves of that class which are designed to employ either natural or artificial gases as a fuel in such a manner that, if desired, there would be no intermingling of the products of combustion with the heated air, thereby contaminating the same.

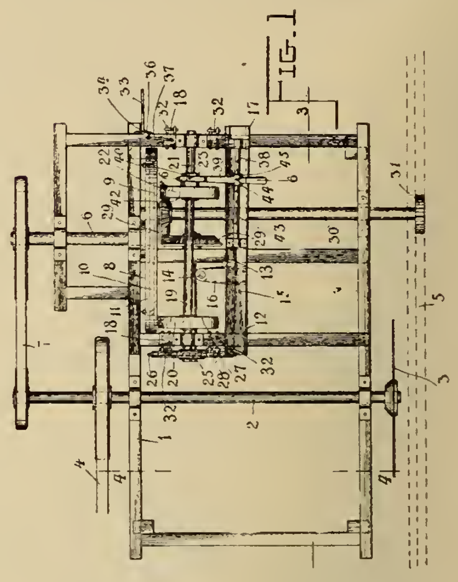
Felly Tire-Set.

Patent No. 786829, issued to Edward N. McComb, Hamilton, Canada. This invention relates to new and useful improvements in felly tire-sets. Its object is to produce in a simple, economical manner a device which may be placed between the contiguous ends of companion felly-segments of a wheel, and be permanently connected therewith, so as to be at all times available for the purpose of adjusting the fellies of a wheel to compensate for shrinkage or swelling thereof under the influence of the weather.

In the drawings, figure 1 is an approximately longitudinal section, taken centrally of improved device. Figure 2 is a plan view thereof looking from the tire side of the wheel. Figure 3 is a sectional view taken substantially on line 33 of figure 1, and figure 4 is a removable bearing-plate adapted to be used in connection with the apparatus. In the drawings, 1 indicates the usual metal tire; 2 and 3, fragments of felly-segments.

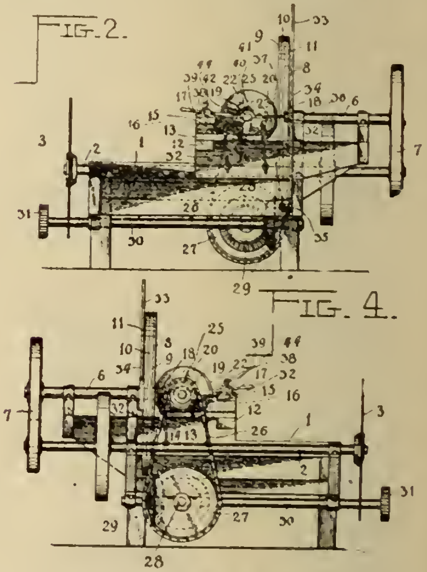
Feeding Mechanism for Saw Mills.

Patent No. 787423, issued to F. E. Woodworth, Grafton, Canada. This invention relates to feeding mechanism for



Feeding Mechanism for Saw Mills.

saw mills, and especially to that type of mill in which a movable carriage advances a log past a continuously rotating circular saw. The object of the invention is to provide improved means for controlling the feed or speed of advance of a carriage and the timber carried thereby. Figure 1 is a plan of a feed mechanism of a mill constructed according to invention. Figure 2 is an



Feeding Mechanism for Saw Mills.

end elevation; figure 3 shows vertical section taken on line 33 figure 1. Figure 4 is a vertical section taken on line 44 figure 1. Figure 5 is a detail elevation upon an enlarged scale, and figure 6 is a section taken on line 66 of figure 1.

Canadian Electrical Association.

ONE of the industrial societies that bids fair to assume large proportions is the Canadian Electrical Association whose annual convention is to be held in the rooms of the Canadian Society of Civil Engineers in Montreal on June 21, 22 and 23. As a society it appeals to a large class, hence it has a broad field of usefulness. Its membership consists of consulting electrical engineers, electrical manufacturers, central station superintendents, electrical contractors and workers, as well as numerous others associated or in some way interested in the electrical trades. From a small beginning it has worked up to an important organization, and we predict that its present prosperous status is but the commencement of greater things. The time is coming in Canada, and that soon, when the electrical interests will be one of the foremost factors. The electrical era in Canada appears in a fair way to be realized when our mighty water-power will be made to work, and mills and factories west and east will be run by electricity. In a few months we will have the greatest water-power development in the world. Hence in a country where electricity is to play so important a part the electrical association should be an influential and a guiding body, and such the organization in Canada is coming to be.

The extent of country to be covered prevents any one body doing the best possible and the most effective work. The accomplishment of this lies not alone in the meeting of a central organization once a year, but in the formation of district or provincial societies along the same line as the branches of the American Institute of Electrical Engineers. There is material for at least four or five such branches of the Canadian Electrical Association in Canada. The formation of these will not only awaken and strengthen and keep alive matters of electrical interest locally, but would be a boon to the parent organization.

It is not intended here to dictate any policy to the society, but merely to throw out a hint concerning a line of progress upon which it might be well to expend some thought.

The interest that is being shown in the association is evidenced from the fact of the large number of important papers that have been promised to be read and discussed, amongst which are the following: "Transformers," by R. T. MacKeen, Canadian General Electric Co., Toronto; "Operation of Transformers at Varying Frequencies and Voltages," by M. A. Sammett, Montreal Light, Heat & Power Co.; "Induction Motors," by H. A. Burson, M.Sc., Allis-Chalmers-Bullock Co., Montreal; "Economy of Isolated Plants," by K. L. Aitken, Consulting Electrical Engineer, Toronto; "Carrying Capacity of Enclosed Conductors," by Professor R. B. Owens, McGill University.

Another feature of the meeting, and one which has heretofore been most successful and of great value not only to those who have taken part by contributing, but to the whole body, is the question box, under the management of A. A. Dion, of Ottawa, who has conducted it with such good results in the past. The questions are of a practical kind and cover the entire range of central station practice and equipment. They are grouped under classified headings as follows: Management; rates; water wheels; boilers, engines, steam turbines; generators, motors, station operation; lines, wires, cables, wiring and testing; transformers and grounding; meters; lamps; miscellaneous. This department is one of the most popular features of the meetings, inasmuch as a greater number of the members are contributors, and also because of the many points brought out and settled satisfactorily.

K. B. Thornton
President Canadian Electrical Association.

During the convention the association is to be entertained at luncheon by the Allis-Chalmers-Bullock Co. at their works. A smoking concert is also one of the features, as well as visits to the various sub-stations of the Montreal Light, Heat & Power Co., while a proposition is also on foot to run an excursion to Shawinigan Falls to see the large new units that the company are adding to their equipment.

Through the courtesy of the McGill University authorities, their laboratories will be open to the delegates at the convention. This will give those who have not had the privilege of seeing them before a chance to appreciate the work that is done there. The electrical laboratories will be of particular interest to the visitors, apart from a technical appreciation, since it is conceded that for equipment and lay-out they are not surpassed by any university in the world.

The committee, under whose direction the local arrangements are being made, include Messrs. H. D. Bayne, Canadian Westinghouse Co. (chairman); R. E. T. Pringle; Professor R. B. Owens; H. J. Fuller (the Fairbanks Co.); C. F. Sise, jun., assistant supreintendent Bell Telephone Co.; Edgar McDougall (Caledonian Iron Works); Ed. F. Sise, manager Wire & Cable Co.; R. S. Kelsch, consulting engineer; Wallace C. Johnson(Shawinigan Water & Power Co.); W. F. Dean (Canadian General Electric Co.); Alfred Collyer (Allis-Chalmers-Bullock).

No effort has been spared by those who have the matter in hand to make this convention of the Canadian Electrical Association the most enthusiastic and valuable that has yet been held, and from the interest that is everywhere manifest in electrical affairs, and from the amount of electrical development under way in Canada, and the large number of representatives coming from different parts of the country, there is no doubt but that the most hopeful expectations will be realized.

One of the most noticeable features today in the building and construction trades is the fact that numerous western railroads (American) are abandoning the ties, and bridges, and are placing in their stead concrete. This change in all probability is due to the increased traffic which in turn causes a heavier strain on the road.

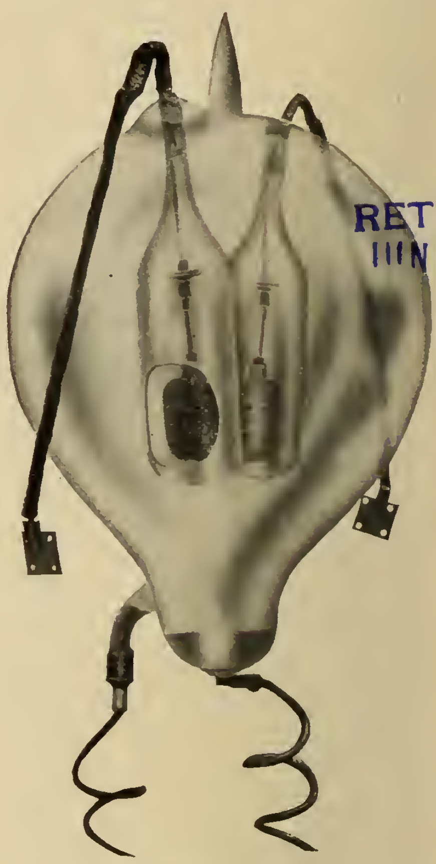
Mercury Vapor Converter

SINCE the introduction of mercury arc lamps another phase has been developed on scientific principles, resulting in the evolution of the vapor converter invented by Mr. Cooper Hewitt, whose earlier researches culminated in the mercury lamp. These converters, of which illustrations are shown, are designed for charging small storage batteries from a single phase alternating current supply. The apparatus necessary to accomplish such change in conjunction with the converter, together with the instruments used, are also shown. This innovation should, to some degree at least, solve the problem of charging storage batteries for small units such as automobiles or electric launches. The outfit may be placed anywhere, and is quite portable.

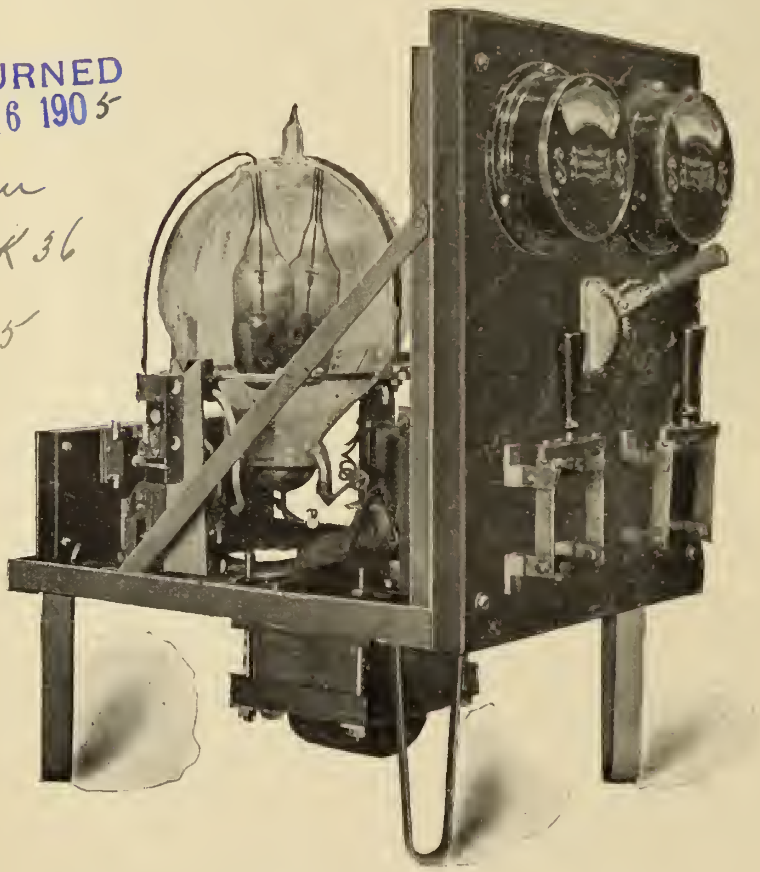
The possibility of the conversion of alternating into direct current depends upon the laws which underlie the well-known starting characteristics of mercury vapor lamps. Since, as in the mercury vapor lamp, no electrode will allow current to enter it until its starting or "negative electrode" resistance is overcome, the positive electrodes will pass current only in a given direction and oppose all current flow in the opposite direction. Consequently, current flows through the negative electrode in one direction only, which gives the desired direct current. It is, of course, assumed that the starting resistance of the "negative electrode" has been overcome by starting the converter, and that this resistance is not permitted to re-establish itself. Since at the zero point of the electro-motive-force wave the current would naturally drop to zero, a choke coil is used to cause a lag in the current from either positive, which will carry the current over the zero point of the E.M.F. supply.

Description of Outfit.

The outfit includes the following parts: Converter bulb: An exhausted glass tube about 9 inches in diameter containing the electrodes. It is mounted in a metal ring supported on knife edges to allow the tilting motion for starting. Sustaining coil: An inductance coil mounted below the bulb, resembling in appearance a small transformer, serves to steady the direct current and bridge the zero point of the electro-motive-force wave of the supply. Regulator: An adjustable inductance coil mounted behind the panel and serving to control the current strength. Panel: A marbelized slate panel carrying a direct current ammeter and a direct current voltmeter and the handle of the regulator, as well as the switches controlling the alternating and direct currents. Auxiliary apparatus: Including tilting magnet, cut-out for tilting magnet, small resistances, supporting frame, slate terminal board, etc. Auto transformer: Mounted separately and serving to adapt the voltage of the supply to the direct current voltage, and also to furnish the middle point of the alternating supply.



Mercury Vapor Converter.



Converter and Controller Apparatus.

Installation and Operation.

This outfit, manufactured by the Cooper, Hewitt Electric Co., New York, can be readily installed in any garage or private automobile house, wherever single phase alternating current is available. It occupies a space of about 15 x 22 inches and is 26 inches high, and is provided with short legs for mounting upon the floor or a shelf, or may be supplied with brackets by means of which it may be supported from a vertical surface. No expert knowledge is required to operate the converter, which is entirely automatic in its action. It is started by the closing of the alternating and direct current switches, and the current which is indicated by the ammeter upon the panel may be readily adjusted by the regulating handle.

CANADIAN MANUFACTURERS' EXCURSION

On June 9, the long-anticipated excursion of the Canadian Manufacturers' Association to Great Britain left Montreal on board the turbine liner, the Victorian. The excursion party numbers about 265 persons,—members of the association, with their wives and children,—as representative a body of Canadian men and women as ever left the shores of the Dominion.

On board the Victorian the excursion party will practically own the boat and no expense will be spared to make them perfectly at home. In the Old Country they will receive an enthusiastic welcome and every door will be thrown wide open for them. A complete itinerary for every hour of their time has been prepared.

In brief, the programme may be outlined as follows: Upon arrival in Liverpool on June 17, the party will proceed directly to London, where they will be entertained for ten days by the London Chamber of Commerce. Though London is a huge place, the excursionists anticipate seeing nearly everything that is worth seeing during that time.

On June 27, they will board a special train, which will convey them as far as Glasgow. They will stop at every important centre on the way and will visit the more important industries. The trip to Glasgow will consume another ten days. The party will then break up and the excursionists will be at liberty to go wherever they desire. The official return voyage will be made from Liverpool on the Victorian about July 20.

Among the officers of the association who will take in the excursion are: W. K. George, Toronto, president; C. C. Ballantyne, Montreal, vice-president; G. E. Amyot, Quebec, vice-president for Quebec; John Hendry, Vancouver, vice-president for British Columbia; W. K. McNaught, Toronto, chairman of the tariff committee; P. H. Burton, Toronto, chairman of the insurance committee; Robert Crean, Toronto, chairman of the reception and membership committee. R. J. Younge, the general secretary, who has been in charge of the arrangements, will accompany the party and will supply all information.

The significance of this trip cannot be overlooked. It is the first event of its kind. The presence in the Old Country of 265 of Canada's leading sons and daughters cannot fail to open the eyes of Britishers to the importance of the Dominion. The official receptions, which they will receive, will be recorded in the British press and thus every one will learn of their presence. This will lead to enquiries about them and gradually it will dawn on the British mind that Canada must be indeed a land of happiness and wealth when it produces such people and supplies the means to send them in luxury thousands of miles across the seas.

Nor can the significance of the fact that the excursionists represent the industries of the country be overlooked. Canada is regarded as a land rich in agricultural possibilities. Few in Britain realize the possibilities of its industries. On this point the excursionists will enlighten them, showing them the vast resources of mine and forest, the gigantic water-powers and the admirable facilities for transportation by

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PERSONAL MENTION.

Mr. H. H. Henshaw has been appointed general manager of Allis-Chalmers-Bullock, Limited, Montreal. Born in St. Hyacinthe in 1865, he first entered

H. H. Henshaw, Montreal.
General Manager of Allis-Chalmers-Bullock, Limited.

the office of Mr. Walker, chief accountant of the Grand Trunk, in 1880. He remained there until 1886, when he was appointed secretary-treasurer of the Royal Electric Co. During the next four years, when that company carried on its manufacturing department, Mr. Henshaw came into contact with manufacturers, electricians and engineers all over the country, and after it disposed of its manufacturing interests he not only retained his relations with them but made many new acquaintances in the business world. He remained as secretary-treasurer of the company until its absorption in the Montreal Light, Heat & Power Co., of which he also became secretary-treasurer, and remained in that position until the present appointment.

Mr. G. A. Nolton has been given charge of the first contingent of the Grand Trunk Pacific engineers, which arrived in Fort William on May 19th, ready to commence immediate operations.

Mr. J. H. Plummer, president of the Dominion Iron & Steel Co., has sufficiently recovered from his illness, extending since the first of the year, to enable him to be outdoors. As soon as possible he will take a trip south to recuperate further.

At a recent meeting of the board of directors of the Westinghouse Electric & Mfg. Co., held in New York, Mr. E. M. Herr was elected first vice-president and chief executive under the president. The advent of heavy electric traction and the adoption of electricity by main line railways, render the services of a man, skilled not only in manufacture but also conversant with railroad operations, specially desirable at this time.

Mr. S. C. De Witt has been appointed sales agent for Allis-Chalmers-Bullock, Limited, Montreal, for the Maritime Provinces, with headquarters at Halifax. He is a graduate in electrical engineering of Lehigh University, Pennsylvania, and has had considerable experience in different lines of electrical work. For the past three years he was manager of the De Witt Electric Co., Limited, with places of business at Sydney, Glace Bay, Pictou, Truro, N.S., and Fredericton. He is a son of Dr. De Witt, present mayor of Wolfville N.S., and being a native of the province and well acquainted with the business in the east, will no doubt prove a valuable acquisition to the staff of the company.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Co., returned on the 5th inst from Europe, where he has spent the last six weeks in the interest of the company. He brought with him orders for 3,400 tools for shipment from America, representing a value of over $300,000. Mr. Duntley states that the trip was the most successful he has ever experienced, and owing to the growing demand for pneumatic tools in England, and on the continent, it was found necessary to extend the organization of the foreign business. In order to accomplish this the factory and business of E. G. Eckstein, Berlin, Germany, and that of the Lencke Co., St. Petersburg, Russia, were purchased, and will be operated for the purpose of meeting these requirements in the continental countries. Pneumatic tools are rapidly being introduced in ship building and other industries in Russia, Austria, Germany, Italy, France, etc., and a largely increased demand for the various devices is anticipated. The line of electric drills exhibited and demonstrated was extremely successful, and large orders received therefor.

ENGINEERING NEWS

AND BUSINESS NOTES

SOCIETY OFFICERS.

Canadian Society of Civil Engineers.

Officers for 1905: President, Ernest Marceau, Montreal; vice-presidents, C. H. Keefer, Ottawa; D. Macpherson, Montreal; and G. A. Mountain, Ottawa; treasurer, H. Irwin; secretary, C. H. McLeod. Rooms: 877 Dorchester st, Montreal.

Engineers' Club of Toronto.

President, R. F. Tate; first vice-president, F. L. Somerville; second vice-president, T. B. Smith; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms: King street W., Toronto.

Canadian Mining Institute.

President, George R. Smith; Thetford Mines, Quebec; vice-president, Thomas Cantley, New Glasgow, N.S.; secretary, H. Mortimer Land, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Canadian Electrical Association.

President, K. B. Thornton, Montreal; first vice-president, A. A. Wright, Renfrew; second vice-president, R. G. Black, Toronto; secretary-treasurer, C. H. Mortimer, Toronto.

Toronto Branch A.I.E.E.

Chairman, T. R. Rosebrough; vice-chairman, H. A. Moore; secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Association of Stationary Engineers.

President, Chas. Moseley, Toronto; secretary, A. M. Wickens, Toronto.

Ontario Association of Stationary Engineers.

President. F. W. Donaldson; registrar, J. G. Bain, 113 Yorkville avenue, Toronto.

Engineers' Society S.P.S.

At a recent meeting of the School of Practical Science Toronto, the following officers were elected: President, J. P. Charlebois; vice-president, E. L. Cousins; recording secretary, E. C. Ash; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriss. The annual year book of the society has just been published containing the papers read before its members within the past year.

Engineering at Oxford.

The University at Oxford, England, has established a diploma in scientific and mining subjects and the committee appointed to arrange details of the scheme has issued the regulations concerning the diploma. The subjects that may be offered are: (a) Mathematics for applied science; (b) physics and chemistry; (c) French and German translation; (d) engineering principles and machine drawing; (e) surveying; (f) geology; (g) mineralogy; (h) mining and engineering, hygiene and mine ventilation; (i) electricity; (j) assaying. For the ordinary diploma candidates will be required to pass in (a), (b) and (c), and in not less than three of the remaining subjects, provided that (f), (g) and (i) are not taken together without one or more of the others. Candidates who propose to become colliery managers and desire to obtain exemption from two of the five years' underground work required by the Home Office as a qualification for a certificate as colliery manager, must obtain a special diploma by passing in the subjects (a), (b), (c), (h), and three (not being f, g, i) of the remainder, and by taking their four months' course of practical training at a mine.

Electrical Engineers' Excursion.

Members and friends of the Toronto Branch of the American Institute of Electrical Engineers to the number of about thirty-five enjoyed an excursion to Niagara Falls on Friday, June 2, where they inspected the works of the different electrical companies as they draw on nearer completion. When at the Falls the party were the guests of the Electrical Development Co., Canadian Niagara Power Co., and the Ontario Power Co., by whom they were entertained at lunch at Dufferin Cafe shortly after their arrival at the Falls.

The sub-station and power house of the Ontario-Niagara Power Co. were first visited. This company have their plant well under way and it is anticipated to turn their first wheel on July 1. Two direct-connected units are in place and another well towards completion.

The Canadian Niagara Power Co. have made further progress and have five generators with their connecting shafts and generators well towards installation, two of them being at present in a position to deliver power. Work on the wheel pit has advanced rapidly and accommodation for six more generating sets is being made, when the power house will be extended a corresponding amount. Although less advanced than the others, the undertaking of the Electrical Development Co. probably offers the greatest attraction, on account of the difficulties encountered in the construction of their coffer dam and tail-race tunnel. It will probably be a year before this company is ready to generate electricity. A wheel pit has been dug and is at present being lined. The total amount of engineering work at present going on at Niagara Falls is stupendous and can only be realized by one actually on the spot. An account of these companies and the work they were undertaking appeared in the columns of the February issue of Canadian Machinery.

Boiler-Makers' Association.

At the fourth annual convention of the Master Steam Boiler-Makers' Association, held at the Great Northern Hotel, Chicago, on June 5, 6, 7 and 8, a large number of proposed rules were discussed. They include rules dealing with specifications for cylinders, spheres and flat surfaces, braces and stays, reinforced surfaces, tubes, rivets, safety valves, as well as decisions regarding the water line and the stamping of boilers. In the discussion of these questions a large amount of useful information was brought forth.

Stationary Engineers Meet.

The British Columbia Association of Stationary Engineers held their second annual meeting at Victoria recently, when a long and important session was held and many matters pertaining to the welfare of the association were dealt with. The meetings terminated with a banquet held at the Victoria Hotel. The new officers of the Grand Lodge are: Grand chief, C. W. Ross, Victoria; grand vice-chief, G. W. McKenzie, Nanaimo; grand treasurer, W. Reese, New Westminster; grand secretary, W. A. Robertson, Vancouver; and grand door guard, Robert Graham, Coquitlam.

Architects' Exams.

The results of the annual examination of the Ontario Association of Architects are as follows:

First examination—R. A. Abraham, passed; David Hood, J. Irving Lawson, C. V. McGiffin, and James D. Wilson, each allowed a supplemental examination in one subject.

Second examination—G. O. M. West, A. P. Allen, and L. C. Montizambert passed, and Victor C. Morgan allowed a supplemental in one subject.

Final examination—A. E. Nicholson, Edwin Menges, W. F. Sparling, and J. A. Mackenzie passed.

CANADIAN

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AND MANUFACTURING NEWS

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BE PROGRESSIVE.

AS Canada develops as a manufacturing country, competition must inevitably increase. Every manufacturer and every machinist must, therefore, keep in touch with the development in machinery construction and machinery practice.

To keep in touch with this development it is necessary nowadays to read the best technical papers and to examine carefully what each advertiser has to say. The machinist, to equip his shop with the most satisfactory tools, must be posted as to the comparative merits of the makes of various manufacturers who desire to sell him. This information is most readily secured through the technical press.

When an advertiser does not give full details concerning his product the reader should, in order to get the information he desires, write to the advertiser for full details. The latter is using the most modern way to give information about his line and it simplifies the relations between himself and the readers (his possible customers) when the latter write to him for complete details. The shrewdest buyers answer advertisers; the shrewdest advertisers appreciate such answers and will go out of their way to give the information desired. To answer an advertisement does not infer an intention to purchase; it is an acknowledgment of interest and is a compliment from a progressive buyer to a skilful advertiser.

SHORT-SIGHTED ECONOMY.

OFTENTIMES when an attempt to economise is made, there is an opposite reaction, and what was considered a saving, acts as an extra expense. In a machine shop this is sometimes portrayed by the inefficiency or unsuitability of the equipment of the shop for the work to be turned out, in which case it is probably the result of an irregular calculation or an incorrect assumption. An instance of this would be the choosing of machine tools for the equipment of a shop where relative cost is given so much consideration that relative efficiency is lost sight of.

Such, however, is not the most frequent representation of this over-economic spirit. It is noticed chiefly in small things, and false economy in these cases is almost altogether due to a non-realization of the requirements of the case or the true condition of affairs. As an actual instance of the latter, there is in the machine shop of a certain repair works employing from 150 to 200 men, for grinding tools, etc., two dry emery wheels, one corundum wheel and a grindstone. There are used in this shop three kinds of tool steel, cast steel, which has to be hardened by suddenly cooling in water, oil or other liquid, air-hardening steel, which is hardened by cooling in an air blast, and self-hardening steel. Strictly speaking, after the cast steel, and the air-hardening steel have been hardened and tempered they should not be touched to a dry emery or corundum wheel because of the readiness with which the temper can be drawn by heating and then cooling slowly. This was realized by the superintendent of the works and the management were applied to for a wet emery grinder. However, for reasons unknown on the outside, there have been delays and further delays, and yet there is no wet stone. Meanwhile all the grinding is done on the dry grinders or on the grindstone—the grindstone not being used much because of its slowness. For simple grinding these serve the purpose fairly well. However, if it is necessary to change the shape of, or grind deep nicks out of, cast steel or air-hardening steel tools, there is great danger of overheating the steel and thus drawing the temper. Then, of course, the tools have to go back to the blacksmith's shop, which necessitates delay and represents lost time. Probably if the management realized the immediate necessity for this grinder it would be forthcoming at once. But they cannot, either because of too much "red tape" in the system or through downright negligence on the part of those through whose hands the order has to pass.

REPUTATION.

QUEER thing, this reputation. It takes toiling and moiling to get it—takes singleness of purpose and capacity to resist temptation to cheapen; but once you've got it, its value is transcendent and can't be computed in dollars and cents. How infinitely better it is to build on a foundation of quality and worth than to chase the will-o'-the wisp of cheapness, which leads you into bogs and swamps.

No manufacturer who has reached a high position in his time for solid worth regrets the price. The years of labor and the setbacks and disappointments are as nothing compared with the satisfaction of the achievement. To accomplish the greater success he must produce the best possible output for the price and the very effort to do so in itself leads towards the desired end.

MACHINE TOOLS AND HIGH-SPEED STEEL.

IT is interesting to notice the effect on shop practice and on the design of machine tools that the introduction of late years of the different high speed steels has had. In former times, before competition among the machine tool builders became keen, tools were built much more substantially and heavily than necessary for the work they had to do. As the industry advanced competition became keener, economy of material became a factor, and more and more attention was given to neatness of design. The old styles of tools were looked upon as heavy, clumsy, ugly and uselessly powerful. As a result of the economy in material and design, the safety factor in the tools became less and less, until one firm in Canada started to manufacture a class of lathes the tail-stock of which was so light that the dead centre was found by those who used them to spring away from the work.

With the introduction of high speed steels a revolution was caused in machine tool design, and now practically all up-to-date tool builders are turning out tools which for heaviness and stability equal the machines of years ago, although, of course, having the metal distributed to better advantage. This was made necessary in order to make the most of the high speed steels, the tools of lighter build not being able to stand the strain of running high speed steel tools at their greatest capacity.

To see the development in machine tool construction, and the reasons for it, one has only to go into a shop that has been established some time. Here he will see the old, heavily constructed English lathe, now no longer despised for its strength of construction, and he will note that it is doing excellent work with the high speed steels; he will also see the light type of lathe, probably either Canadian or American, which he can tell at a glance is not strong enough to stand the strain of a cut that the high speed steel is capable of taking. This is very noticeable in planers. If the steel is taking the cut that it should the planer table is lifting, thus causing the tool to chatter; or if the table is running smoothly justice is not being done the steel. If the shop is quite up-to-date the visitor will see the latest machine tool, the one which is specially designed for high speed steel. This, with all its modern refinements, works perfectly.

In the majority of shops the best working value is not obtained from high speed steel because of this very fact, that many of the tools in the shop cannot stand the strain imposed when high speed steel is working to advantage, and in such shops as these a fair comparison cannot be made between the modern steels and the old cast steels.

CRIPPLING INDUSTRY.

THE gross injustice that can be inflicted by a corporation upon private enterprise and industry is being shown in the discrimination of freight rates against Canadian manufacturers and business men. That such should be true and that actual harm has been done from this source may not be generally known, yet it remains that within the past fortnight the American Cereal Co. posted a notice in its works at Peterboro that the mills would be closed indefinitely, or until satisfactory adjustment of freight rates could be made. It is stated that they have no lack of orders or export consignments, but excessive freight rates are the sole cause of closing down. This is a fertile subject of investigation for the Railway Commission, and it is hoped that the matter will be taken in hand without delay, as to whether the charges of the railway companies are really menacing industry in such a manner. It is a serious matter and a question in which not only the manufacturer but the retailer and the consumer are vitally interested.

MACHINERY IN JAPAN.

ACCORDING to the official returns, $131,000 worth of agricultural and industrial implements were imported into Japan in 1903, and it is believed a much larger amount in 1904. This is but a beginning. A few years hence will see the wily Jap importing machinery of all classes for the establishment of industries. With the improvement of farming conditions there should be bigger demand for agricultural implements as well as the increase caused by the progress of engineering work, so that it would be well for firms looking for foreign trade to keep an eye on the little brown man from Japan for future trade relations.

ACCURATE MEASUREMENTS.

MACHINISTS' work is considered by many to require a range of accuracy carried to no special degree in comparison with that of watchmakers, silversmiths and other skilled artisans along that line. This idea is due to the lack of accurate knowledge of existing conditions, for in no other branch of the mechanical craft has the approach to perfection been reached as in some products of the machinists' skill. Less than a generation ago this conception may have had grounds for existence, but such is not the case today. Older methods have given way to modern practice, until we find the skilled machinist turning out work to a nicety of finish that renders any differentiation between it and the best product of other skilled workers out of the question altogether, unless it be with a view of giving the verdict in favor of the machinists' handiwork. As in all other branches of manufacture, upon the circumstances of the case depend the degree of precision required, so that, while in some classes of work anything approaching 1-64 of an inch is near enough, work is done to the one ten-thousandths of an inch with absolute reliability. This is an attainment to which even the engineer in his calculations on structural work does not aspire, although the popular vote would favor the engineer and his slide rule in discussing the question.

Turning down the shafting for a bearing requires no particular correctness, nor demands a thorough training, but the manufacture of the modern machine tool or the making of machinists' measuring instrument calls for a specialist in the mechanical line; and the men as well as the machines have been an evolution of modern industrial progress.

THE NEW EDUCATION

THE last half century has seen a remarkable development of nearly all the arts of agriculture, commerce and manufactures, and it would be strange indeed if some corresponding change did not appear in the schemes of education that are to fit our young men and young women for the new order of things.

Formerly, students who wished to acquire the elements of a liberal education were required to spend their time on Latin and Greek, with some algebra and geometry, and, perhaps, a foreign language, such as French or, later, German. Years were spent in the study of works of ancient writers who would have been most of all astonished had they known to what uses their works were to be put. The unhappy schoolboy had his mind crammed with declensions and conjugations and few there were who ever rose beyond this to a grasp of the Latin or Greek tongue sufficient to enable them to read with pleasure or profit the works of classic authors. This was the case for hundreds of years in England. He was a bold man who first drew public attention to the fact that boys and girls had not only memories, that they had human bodies which they might learn how to care for, that their own country had a history and a literature as honorable and as interesting as those of Greece or Rome. Moreover, it appeared that ninety per cent. of students were not going to be gentlemen of leisure or professional men, but were going to earn their livings in commerce or mechanic arts. Could not some scheme of education be arranged that would meet their wants ?

The answer has come in many ways. Little by little dead languages have given way to living tongues, chemistry and physics have found their way into the curriculum and more and more attention has been paid to the art of writing and speaking fluently our own language. Greek has been dropped from the course of study in most of our high schools and Latin seems to be following it.

No better evidence of the growth of the new ideas can be offered than the remarkable popularity of technical and commercial schools. The growth of the movement in Toronto is an illustration. A beginning was made about twelve years ago when the Trades and Labor Council persuaded the city fathers to give a grant of $3,000 to assist in the establishment of night schools where apprentices and artisans might study mathematics, architectural drawing, machine drawing, chemistry, etc. At first about 200 students gathered together in old Wycliffe Hall on College street.

As year by year the work expanded new courses were added and the attendance grew very rapidly. In twelve years the number of students had increased tenfold. A larger building and a larger staff became necessary, and the Technical School Board got from the citv the use of the large building on College street, formerly the home of the Toronto Athletic Club. In 1901 a day school was started with an attendance of about fifty. To-day the average attendance of the day classes is over five hundred and the night students number about one thousand. About a year ago the Public School Board, Collegiate Institute Board and Technical School Board were amalgamated as the Board of Education for Toronto, and the Technical School was reorganized as a fourth collegiate institute for special purposes under the name of the Technical High School.

The students of the day school are of the same standing as those who attend the collegiate institutes. They must have passed the Entrance examination. They have the same hours as in the collegiate institutes, and the teachers are legally qualified specialists in their departments. A full commercial course is given. There are departments of domestic science and art, architectural and machine drawing, applied mathematics, physics and chemistry, and English literature and composition, history and commercial geography are required with every course, and there are large classes in commercial French. The idea throughout is to make the student as efficient as possible in every way, and to use for this purpose those arts and sciences which will be directly useful to him in after life. A good beginning has been made and its success is vouched for by the large attendance. In the day shcool alone the attendance is half as large again as that of any collegiate institute in the city and the night students are twice as numerous as the day students.

But much remains to be done. Practical technical education is bound to be expensive. Apparatus and supplies must be furnished. Business offices are required and shops for illustrative work in mechanics. It is certain that the citizens will respond to the needs of a department of education which ministers specially to the needs of those who intend to enter commerce or to pursue mechanic arts, for these number at least ninety per cent. of the people in Toronto to-day.

MARCONI TRIUMPHANT.

UPON the arrival of the Campania at New York on May 27, the merits and possibilities of wireless telegraphy were further exemplified than heretofore. A signal triumph had been achieved. For the first time since Marconi astounded the world with his announcement, a vessel crossing the Atlanti had kept in communication with land all the time. It is an event in the history of science and progress well worth recording and deserving of particular note. The passenger crossing the ocean will no longer be out of touch with the world's events, but may now receive daily the news of men and affairs as readily as at home. The steamship companies should feel a thrill of pleasure as it no doubt adds safety to the voyage and makes uncertainty a thing of the past.

The above feat followed closely upon the decision of the United States court in favor of the Marconi patent in a suit brought against the owners of the DeForest patents for infringement of patent by the American Marconi Wireless Telegraph Co. Certain claims in the Marconi patent, without which no wireless telegraphy is practicable, are declared valid by the United States courts, and to have been infringed by the DeForest.

The Canadian Government may now compliment itself on the fact that it was the first to adopt the Marconi system and that it is at present establishing Marconi stations along the St. Lawrence route.

Practical Questions and Answers

Referred Mean Pressure.

Ques. A subscriber asks what is meant when speaking of the pressure of an engine in saying "referred mean pressure."

Ans. This expression is used only in connection with a compound or multiple expansion engine, and is defined briefly: the mean effective pressure which would give in the low pressure cylinder an amount of work equal to that given in the actual engine in the two, three or four cylinders collectively.

Horse-Power of Boiler for Pump.

Ques. What is the rule to find the horse-power of a boiler required to furnish steam for a pump running at its fullest capacity ?

Ans. To get the weight of water pumped it is necessary to multiply the number of gallons delivered by the pump by 8 1-3. This, when multiplied by the total height vertically to which the water is to be lifted, gives the number of foot pound of work done in lifting the volume of water to that height in one minute. As 33,000 foot pounds of work per minute represents a horse-power, the product provided by 33,000 will give the number of horse-power necessary to do the actual work. Adding on say 50 per cent. for loss from friction of water in the pipe, friction in the pump, waste steam in the cylinder, etc., will give a fair estimate of the capacity of the boiler required to do the given amount of work in connection with pumping.

Process of Mechanical Refrigeration.

Ques. In mechanical refrigeration, how is the low temperature reached; and what is the process employed to bring about such a result ?

Ans. In mechanical refrigeration the process consists in removing heat, and it is necessary to employ mechanical means since the rooms and apparatus from which the heat is to be removed are already as cold or colder than their surroundings. When this latter is the case it is natural for the heat to flow from the warmer room to the cooler chamber or apparatus. The term cold is really relative. In practice the only means by which heat can be removed from a body is by bringing it in contact with something cooler than itself, that the heat which is stored up in it may flow to the cooler body. Hence, in mechanical refrigeration, ammonia is used and manipulated so as to become colder than the body which it is intended to cool. The heat thus absorbed by the cool ammonia is got rid of by further manipulation. It thus acts like a sponge, sopping up heat in one place and giving it out in another. The operation consists of three parts—the compression side, in which the ammonia gas is compressed; second, a condensing side, consisting of coils of pipe, for the most part, in which the compressed gas circulates, parts with its heat and liquifies; third, an expansion side, consisting also of coils of pipe in which the liquified gas re-expands into a gas, absorbs heat and performs the refrigerating work. That the work may be carried on it is necessary that these three parts are connected together, and the gas pass through them in the order named. Thus we have gas flowing into the expansion of evaporating coils when it vaporizes and expands under pressure. It then passes into the compressor, where it is compressed and forced into the condensor, where a pressure from 125 to 175 pounds per square inch usually exists. When the gas becomes liquid it is allowed to flow to a stop cock, having a minute opening, which separates compression from the expansion side of the plant. The expansion side consists of coils of pipe similar to those of the condensing side, and the reverse operation takes place. When it begins to volatalize it requires heat, and thus must be taken from the surrounding medium, and as a result the surrounding substances are reduced in temperature or cooled.

Case-Hardening Machine Parts.

Ques. What is the best process for case hardening machine steel to be used for machine parts ?

Ans. It is desirable in case hardening machine steel to be used where they will be subjected to pressure or any jarring or compression or excessive wear, that the surface present a hard, close grain. To accomplish this, in order that they may have long life, the parts must not only have a surface as mentioned above, but must be hardened fairly deep. The method of doing this is described by Woodworth in his book, "Hardening, Tempering, Annealing and Forging of Steel." The apparatus required consists of a good hardening oven, a number of hardening boxes, a good supply of raw bone, granulated, the same amount of granulated charcoal, some hydro carbonated bone and the same amount of charred leather. A tank large enough to hold a good supply of water, a small tank so arranged as to allow of heating to any desired temperature, and a bath of raw linseed oil, and the outfit will be complete.

Pack and heat the work as you would for regular case hardening, and leave it in the oven to cool. When perfectly cool heat the pieces in hot lead and quench the same as tool steel. If the pieces are small they should be re-packed in the hardening box with granulated charcoal and heated. When packing in charcoal do not mix with any kind of bone or any other carbonizing matter; such substances open the grain, and the object of the second heat is to close the grain. The hardening heat should be as low as possible, and the hardened pieces will come out close in grain, with a hard, tough surface all over, while the centre remains soft and the piece will be stronger than if made of tool steel.

To harden pieces 4 inches and upward in diameter, the work should be packed in clear raw bone, and heated to an orange, or almost white heat, for 18 hours, and then plunged into cold running water, salt water preferred. If the piece does not harden hard enough at one operation, should be re-packed and heated again, the same as the first time, and plunged into cold water as before. Great care should be taken in heating these pieces. After the heat is up to the required temperature, it should be kept so until the piece is ready to be plunged into the water.

Striking Force of Hammer.

Ques. What is the striking force of a steam hammer weighing, with its piston, 1,500 pounds, which in falling through a distance of 10 feet compresses a piece of iron 5-32 ins.

Ans. In order to accurately determine the force of the blow the velocity of the hammer at the instant of striking must be known, and also the time during which the hammer comes to rest. However, it is difficult to determine this time, and a very close approximate result may be obtained by dividing the kinetic energy of the hammer at the instant of striking by the distance in feet through which the hammer moves before coming to rest. Then the following formula will give the required result :

$$F = \frac{Wv^2}{2gr} = \frac{Wh}{r}, \text{ where}$$

F = striking force in pounds.

W = weight of hammer in pounds.

v = velocity of hammer in feet per sec.

r = the distance penetrated by the hammer in feet.

h = height through which the hammer falls.

Then for the specific problem under consideration

$$F = \frac{1500 \times 10}{\frac{5}{32} \times \frac{1}{12}} = 1152000 \text{ pounds.}$$

This solution is based on the assumption that the steam acting on the top of the piston is used only to prevent a rebound of the hammer.

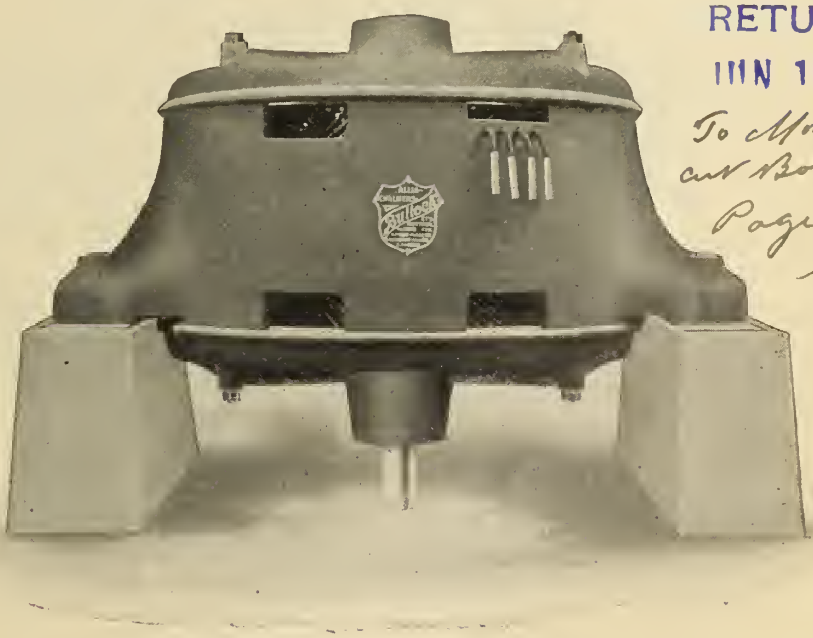
Power and Transmission

Steam Gas Electricity Compressed Air Water

VERTICAL INDUCTION MOTOR.

A NEW type of induction motor has recently been placed on the market by Allis-Chalmers-Bullock, Limited, Montreal. It is built on the same principle as the squirrel cage horizontal motor, which is particularly adapted for service where variable speed is not desired and an extra heavy starting power not necessary. Owing to the absence of sparking they are the only motors suitable for flour mills, powder mills, mines, paint mills, wood-working shops or other industries where there are combustible materials or gases. They are also specially adapted for turbine pumps, because they can be run at high speed without the trouble experienced from the brushes and commutators of direct-current machines.

A very good example of their utility in this respect is afforded by the waterworks plant installed in the town of Lethbridge, Alberta, by Allis-Chalmers-Bullock, Limited. It consists of two vertical 150-h.p. induction motors of 1,200 r.p.m., directly connected by 14-foot shafts to Worthington vertical turbine pumps for domestic purposes, and two horizontal 50-h.p. induction motors similarly connected to horizontal turbine pumps for fire purposes. From a mechanical point of view, the squirrel cage induction motor is an extremely simple machine. It is composed of a stationary part called the stator, which receives the current from, and is permanently connected to, the main circuit, and a rotating part called the rotor, which has no electrical connection with any external circuit. As it has no high voltage windings, commutators or collector rings, the revolving part is free from the troubles found with direct-current machines, such as sparking at the commutators and the wearing out of brushes. There is absolutely no danger of the insulation burning out, as is the case where coils are used. The stationary part, or stator, is built in the usual way, of specially annealed thin steel sheets, which are insulated to reduce the magnetic losses in the iron. But the Allis-Chalmers-Bullock induction motors differ from others, in being treated with a special insulating compound. The coils, having been wrapped in insulating material, are dipped into this compound, and the portions to go within the slots are then pressed and baked in steam moulds. The result is that those portions are as rigid and hard as a single bar of metal, and fit the slots exactly. With other motors it is difficult to remove any of the loosely-wrapped coils without injury. There is no such difficulty with these motors. The compound renders the whole insulation moist-proof, and the ends are made permanently pliable. The coils are all interchangeable, and, therefore, easily repaired.



Allis-Chalmers-Bullock Vertical Induction Motor.

FAIRBANKS-MORSE GAS ENGINES.

IN connection with the establishment of the factory in Canada for the manufacture of Fairbanks-Morse Gas and Gasoline Engines, Canadian manufacturers will no doubt be interested in becoming acquainted with the design in construction of these engines, which will be handled throughout Canada by the Canadian Fairbanks Co., Limited.

The adoption of gas engines is rapidly increasing, and the demand will still further increase, as fast as the public becomes better acquainted with the many advantages that they possess, for their greater economy and convenience entitle them to the preference in most cases.

The Fairbanks-Morse engine has only two valves, and these are the poppet type. Both are water-jacketed, and thus protected form the heat. There is but one cam, which, by means of a straight rod carried in suitable guides, operates the exhaust valve, making the engine free from small or delicate parts. The governor is attached to the hub of the flywheel, and acts directly on the exhaust valve, relieving the engine from compression, and at the same time cuts off the supply of gas when not required.

The power in the Fairbanks-Morse engine is obtained by combustion of gas and air in the engine cylinder; the gas is admitted direct into the cylinder, together with the required amount of air to form a perfect combustible mixture.

This mixture is retained in the cylinder by an automatic acting suction valve. After being compressed the charge in the cylinder is ignited by an electric spark furnished from a small battery, or, if preferred, by the tube igniter. The governor controls the number of explosions in exact proportion to the amount of work, always maintaining a uniform speed. The exhaust valve is held open and relieves the engine from compression when not requiring an explosion. By this all friction is relieved which would otherwise

have been caused by compression. These engines have slow speed and are substantially built. The governor being connected to the flywheel of the engine, requires no gears or belt. The governor automatically regulates the supply of gas, at the same time relieving the engine from compression which would cause extra friction and loss. A steady motion is maintained under part or full load.

The delivery of gas is direct to the air suction in exact and uniform quantities, and with the use of one valve and no delicate gas regulating devices.

The electric igniter in the Fairbanks-Morse engine is exceptionally simple, having no delicate parts or joints to be operated from quick-acting motions to wear and get out of time. There is only one insulated pole to the igniter, the engine forming the other pole. The movement of the igniter is slow and without jerk. It is also adjustable while running, to vary the time of igniting to obtain the best efficiency of the engine.

The tube igniter as used on this engine is of large diameter and quite short. This increases the life and assures more perfect ignition. There is no tube-controlling valve required on this engine when tube igniter is used. The self-starter enables one man to start all sizes of engines. The engine can be worked with coal gas, oil gas, producer gas or natural gas.

A special feature of Fairbanks-Morse engines, and which is possessed by no other engine of this type, is the patent self-starter here shown.

To start by means of a self-starter, the small cup at the base of starter pump is charged with a few drops of gasoline and the detonator is capped, with a common parlor match-head inserted in the fixture attached to the cylinder, and by operating the pump a charge is then forced into the engine cylinder to be fired by the detonator, or the electric igniter can be used. The expansion of this burning charge has sufficient force to start the engine under about half load without jerk or jar. This is one of the most essential features in the starting of a gas engine.

One man can start an engine of from five to one hundred horse-power. There is no chance of failure, as the quality of the charge is the same as that formed by the engine when running.

This starter can be used with either electric igniter or tube igniter, as the igniting of the starter charge is independent of the above igniters. This allows the starter charge to be fired at the most desirable time, giving the best results in the starting.

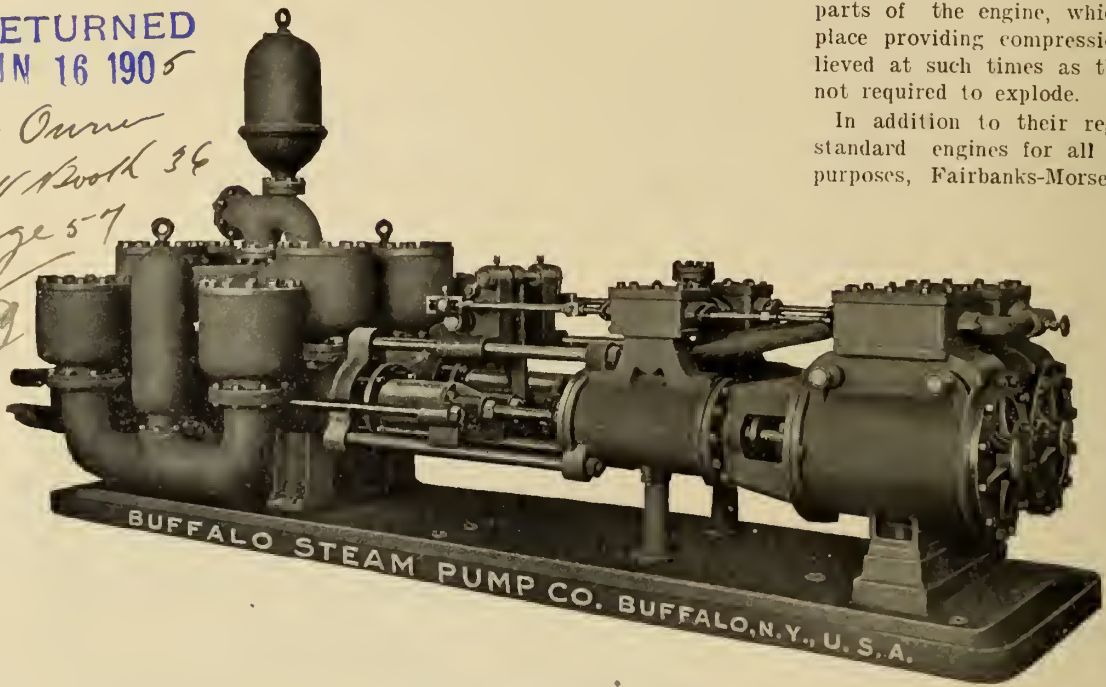
These are very essential features of a successful starter, and can be had only on the Fairbanks-Morse engine.

The cylinder and piston are in section, thus clearly showing the construction of the head, cylinder, exhaust chest, valve and piston, also the arrangement of the rings and water jacket, as well as the connection in the piston for attaching the connecting rod. The exhaust chest is attached to the cylinder by studs, thus making it possible to renew at a small cost should the valve or chest have become damaged by long usage.

The rod is made adjustable at both ends. The piston end is adjusted by a screw elevating a wedge which can be operated from the open end of the cylinder, while the bearing at the crank end is of the marine type, provided with phosphor bronze boxes. The crank shaft, gear and arrangement of the wheel and shaft are plainly shown, and from this the simplicity of the engine with the minimum number of parts is made clear. The valve mechanism is so constructed that but a single cam is used to operate the valve. The arrangement of the governor in the wheel is such that it is connected with a catch which operates direct on the exhaust valve, holding same in an open position when the speed of the engine increases above normal. By this action compression is entirely relieved, thus freeing the engine from friction and resistance, which would otherwise be caused if the engine was allowed to compress. With this method of governing, a saving is effected in both the fuel and the wear on the various parts of the engine, which would take place providing compression is not relieved at such times as the engine was not required to explode.

In addition to their regular line of standard engines for all general power purposes, Fairbanks-Morse also manufacture several special combinations. The designs and construction are exclusively their own, and many novel and essential features are embodied. These combinations are being extensively adopted by various railways, mining corporations, and in many of the cities and small villages, or wherever such various combinations are required, such as: Combined engine and pump, combined engine and geared base, combined engine and geared hoist, combined engine and air compressor, combined engine and direct connected dynamos, and special electric lighting engines.

Special catalogues are issued for each of the above combinations, giving full descriptions, with cuts of same, and can be secured by any of the readers on application to the Canadian Fairbanks Co., Limited, Montreal.



Buffalo Compound Duplex Mine Pump.

BUFFALO COMPOUND DUPLEX MINE PUMP.

THE conditions under which a mine pump operates are about as severe as are ever found in pumping practice, and tax the resources of the designer to the utmost in order to produce a satisfactory unit where efficiency, durability and weight are all conflicting factors. The mine pump pre-eminent is not only expected to handle water which may contain quantities of mud, sand, etc., in suspension, or chemically capable of attacking anything but a glass bottle, but must do so under wide fluctuations in head and suction depth, and yet afford a fair degree of economy. When it is considered that such pumps must be, above all things, reliable, and are handicapped by indifferent care and attention, their salient points cannot fail to be of interest to the engineer.

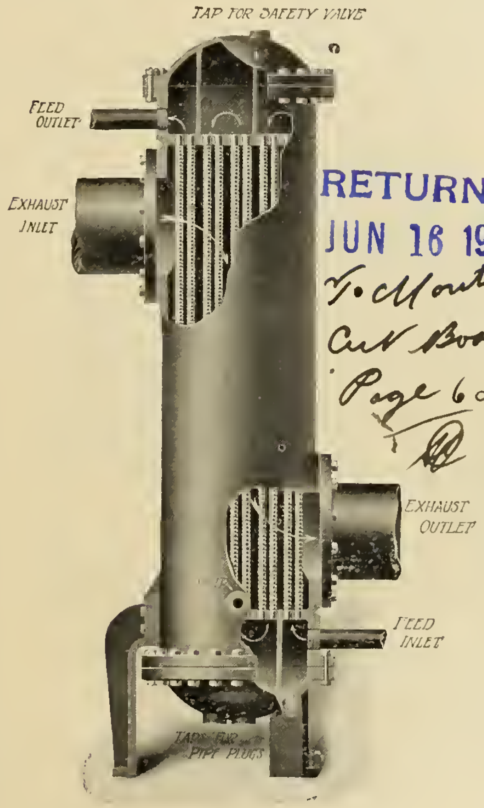
As will be seen from the following description of a standard type of these pumps, the leading idea of the designer has been to facilitate the working qualities at the expense of space, weight and machine shop costs. At points where adjustment, repairs and replacements are inevitable, care has been taken to afford every convenience for their rapid and easy execution.

The pump shown by cut is one built by the Buffalo Steam Pump Co., and has been constructed throughout from entirely new patterns, and embodies every point of excellence that the long experience of the makers could suggest. It is provided with four single acting outside packed water plungers, which work in the ends of the water cylinders, the latter having a partition in the middle. Each pair of plungers are connected together by heavy steel side rods, which are carried through cast steel crossheads, each of which is in turn connected to the piston rod of the tandem steam cylinders. An undesirable feature of most mine pumps lies in the inaccessibility of the water valves. Here both sets of valves are placed in large chambers so located as to be easily gotten at, and at the same time being above the level of the cylinders, insure that same will be always full of water or primed. The uninterrupted area of each set of valves is equal to 50 per cent. of the plunger by which means a noiseless and efficient action is obtained. The steam cylinders are connected by a well designed cradle of sufficient length to provide them with deep stuffing boxes and give ample room for re-packing. The valve stems are provided with means for adjustment and taking up wear, and allow of valves being set without uncovering steam chest.

Any part of the pump can be removed without disturbing the neighboring parts or dismantling the machine. They are built to stand a working pressure of 500 lbs. to the sq. in., and all attachments are especially strong in order to stand the rough usage and lack of attention to which they are often subjected.

The proper and generous distribution of metal in this pump contributes greatly to its smooth action and lack of vibration. Originally designed for mine work, its rugged characteristics have caused its adoption for situations of less severe service, but where its ability to stand up to its work without skilled attendance was a desirable item.

Further information, data, prices, etc., may be obtained from the Canadian Buffalo Forge Co., Montreal, who are affiliated with the previously mentioned concern.



Even-Flow Water Tube and Feed Water Heater.

EVEN-FLOW WATER TUBE AND FEED-WATER HEATER.

THE accompanying illustration represents the Wainwright Feed-Water Heater, manufactured by the Taunton Locomotive Manufacturing Co., for whom the Canadian Fairbanks Co., Limited, are Canadian sales agents. These feed-water heaters are of the closed type and made both in steam tube and water tube patterns. In a closed heater the steam and water do not come in direct contact, and thus any oil which may be in the steam is not allowed to mingle with the feed water. All the heat that passes from the steam to the water in a closed heater must go through the walls of the heating surface. In the case of the Wainwright heater, these walls are always formed by corrugated copper tubes. It takes an appreciable length of time for a body of water to absorb a given amount of heat, and it is, therefore, manifestly impossible to bring the water to exactly the same temperature as the steam, so long as the water is flowing through the heater.

A moderate amount of heating surface will bring the water to within ten degrees of the temperature of the steam which is used as a heating medium. A generous amount of surface will bring the water to within three or four degrees of the temperature of the steam which is used as a heating medium, and no statements as to the temperature to be expected from any heater can be made without a definite understanding as to the quantity of water to be put through in a given time, the amount of heating surface in the heater, the character and quantity of the steam which is to be used as a heating medium, and the initial temperature of the water to be heated. Three of the foregoing elements are within the knowledge of the customer, and, with the final temperature required in the heated water, should be furnished us to enable us to find the size of the heater necessary in any given case.

The Wainwright heater offers more actual horse-power in less space than can be offered in any heater which uses smooth tubes. The depth of the corrugations in the Wainwright tubes, while sufficient to increase greatly their efficiency, does not interfere with the action of the good flue brush, if it becomes necessary to clean out the water tubes.

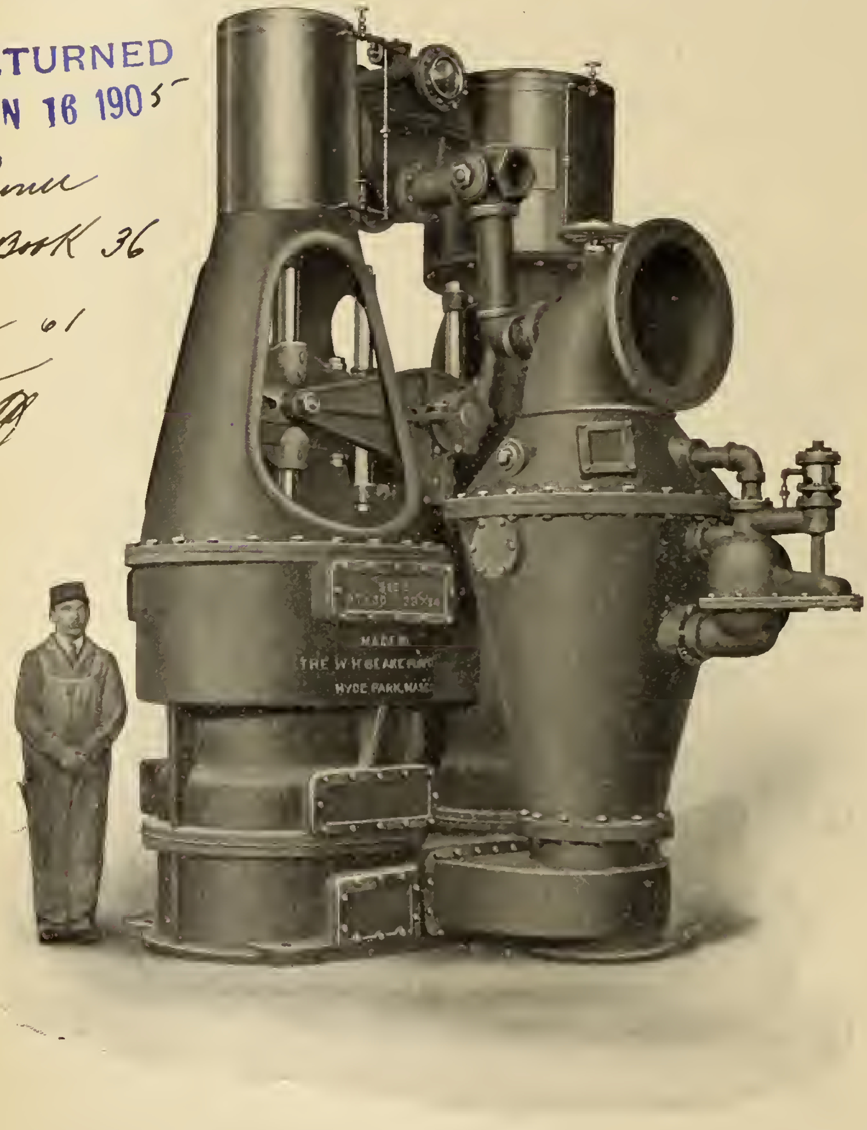
This heater is offered as the results of careful experiments which were begun by Professor Carpenter, of Cornell University, and which have been continued by ourselves and others, and the experiments all show that increased velocity of flow through the tubes gives a correspondingly increased rate of heat absorption by the water. This increase in the rate of heat absorption is especially true in connection with the Wainwright corrugated copper tubes, because the higher the velocity the greater the disturbance of the particles of water as they flow over the corrugations.

The water chambers are divided into several compartments, as shown in the illustration, and the partitions are so arranged that they direct the flow of the feed water back and forth through the heater, using the various groups of tubes in succession, with a consequent increase in velocity over that obtained in the old non-return type of heaters. Each of these groups of tubes contain a sufficient number of tubes to give a sectional area which is at least twice the sectional area of the feed pipe. This

increase in the speed of the feed water brings all parts of it in contact with the heating surface, and insures also a uniform use of all the tubes. Experiments have also shown that in all ordinary multi-tubular heaters the water may remain almost stagnant in a portion of the tubes.

The makers of these heaters guarantee a high final temperature, as high as even 112 degrees under ordinary conditions of exhaust with non-condensing engines.

Any further information desired by any of Canadian Machinery readers will be cheerfully published on application to the Canadian Fairbanks Co., Limited.



Vertical Air Pump and Jet Condenser.

JET vs. SURFACE CONDENSERS.

WHETHER exhaust steam from a condensing engine shall pass to a jet condenser, and there meet the water in direct contact, or shall transfer its heat through the tubes of a surface condenser, depends upon the attendant conditions. In the first instance the condensed steam and water meet and mingle, less water is required to produce a given result, and with less weight and bulk of condenser. If, however, the condensed steam has to be pumped back into the boiler, a portion of the injection water will go with it. This is only admissible when the water is perfectly pure and not harmful to the boiler surfaces. While the surface condenser is somewhat heavier and bulkier, and requires more water to condense a given amount of steam, its use is imperative where for any reason, as on shipboard, the condensed water cannot be fed to the boilers. It is also desirable when the exact steam consumption of the engine is to be determined. The steam circuit then becomes practically a closed system, and it is only necessary to supply from some other source enough water to make good the losses by leakage. Realizing the desirability of providing for a choice in the selection of condensers, the W. H. Blake Steam Pump Co., of Hyde Park, Mass., has perfected a very complete line of both types running in capacity from 600 to 40,000 pounds of steam condensed per hour, with injection water having a temperature of 70 deg. F. From this series the accompanying illustration is selected.

In this form of twin vertical air pump and jet condenser the air pump is made with compound steam cylinders when it is to be operated condensing, and with twin vertical steam cylinders when operated non-condensing and the exhaust steam utilized. Being vertical in construction, all pistons wear equally on all sides, and not downward, as in the horizontal type. The water cylinders are composition lined, all water piston (or bucket) heads are of the same material and fibrous packed. Easy access is afforded to heads, packing and water valves, through a hand hole on either side of pump. The best composition is used in the construction of the water valve seats and guards, the studs are of Tobin bronze, the valves being held in place by locknuts and operated without the aid of springs. The water piston rods are of Tobin bronze, and the steam piston rods of steel.

The injection stem and cone are of composition, access to the same being provided through hand holes on either side of the condenser. The amount of water passing through the condenser is regulated by the vertical adjustment of the injection cone, which acts as a nozzle to form a thin spray, which is thrown out at an angle of 48 degrees. This falls upon a succession of shelves, thus forming secondary sprays through which the exhaust steam from the engine must pass. Instantaneous condensation results with great economy in the use of water. A perforated copper plate is substituted for the shelves when the force of the injection water is not sufficient to produce spray. The combined volume of injection water and condensed steam flows by gravity through the bottom of the condenser into the pump. To prevent flooding of the engine the condenser is provided with an independent vacuum breaker attachment secured to the side of the condenser. This is so arranged that when the water reaches the level of the float chamber the float is raised, and by great leverage forces the check valve from its seat, allowing an inrush of air which instantly breaks the vacuum, thus preventing further suction of water into the condenser and consequent flooding of the engine. The construction of this machine is exceedingly simple, all parts are readily accessible; it is very compact, requiring little floor space, and is operated by the Blake Patent Automatic Valve Motion, without complicated mechanical adjustments.

ABOUT CATALOGUES

Any Catalogue spoken of on this page will be sent upon request. Kindly mention Canadian Machinery

"STEAM SHOVEL NEWS." This is No. 3, Vol. 1, of a magazine devoted to the interest of steam shovels and their work, issued by the Vulcan Iron Works Co., Toledo, Ohio. It contains considerable general as well as technical matter of interest to manufacturers, contractors and power users.

The Browning Engineering Co., Cleveland, Ohio, send a pamphlet describing their automatic grab bucket.

A leaflet sent by W. J. McGuire & Co., contractors, Toronto and Montreal, mentions the automatic fire extinguishers handled by them.

The Geo. R. Rich Mfg. Co. issue a booklet describing their machine shop appliances, and mention some severe tests made on their tools.

Diehl Fans is the title of a 28 page catalogue issued by the Diehl Mfg. Co., Elizabeth Port, N.J. Their ceiling fans are given particular attention in this catalogue.

A twenty-four page catalogue is being sent out by the Pendrith Machinery Co., Adelaide street, Toronto, describing in detail the bakers' and confectioners' machinery manufactured by them.

"A Few Words About Electric Fans" is the name of a little booklet received which describes the Crocker-Wheeler Electric Fans for ventilating offices, stores, schools, factories, etc.

"Summer Comforts" is the title of an attractive booklet published by the Fort Wayne Electric Works, Fort Wayne, describing their electric fans and the many uses to which they may be adapted.

A number of bulletins received from Murray Machinery Co., Kansas City, Mo., describe their furnace and metal pot high rotary planer, pedestal router, and other wood-working machinery.

Dodge Mfg. Co., Limited, Toronto, are sending out their condensed price list of power transmission goods for 1905, which illustrates the different apparatus and gives fully tabulated price lists.

A 34-page booklet issued by Borden Co., Warren, Ohio, is devoted to their geared solid die stocks and solid adjustable die stocks, which embody features of special interest to the trade.

Circular No. 1110, issued by the Westinghouse Electric & Mfg. Co., describes their Catenary Line Construction, and gives full illustrations of the detail, together with data of material, stresses, etc.

Cooper-Hewitt Electric Co., New York, have issued a 28-page catalogue showing different views where the mercury lamp is used to advantage, besides describing the properties and features of their lamp.

"Water Power Equipment" is the name of a booklet issued by the Wellman-Seaver Morgan Co., Cleveland, Ohio, describing their apparatus for equipping power stations where water is of low head.

"Boiler Room Economy" discusses the question of using boiler tube cleaners in a booklet sent out by the William D. Pierce Co., of Buffalo, N.Y. Any user of boilers would do well to write for a copy of this booklet.

The Henry & Wright Mfg. Co., Hartford, Conn., are sending their catalogue of ball bearing drill presses and filing machines and tools. In this the different machines and tools are illustrated and specifications given.

The 1905-'06 calendar for the Ontario School of Practical Science is to hand, containing the information, time tables, student list, and the curriculum of the different branches in engineering at the School of Practical Science.

Catalogue No. 90, issued by Wilmarth & Morman Co., Grand Rapids, Mich., contains full descriptions of the different styles of the new Yankee Drill Grinder, besides data on friction countershafts, arbor presses, and loose pulleys.

The Northwest Machinery & Iron Co., Limited, of Winnipeg, are sending out their 112 page catalogue of blacksmith and carriagemakers tools and supplies; as well as the complete lines of carriage wood goods which they handle.

A large and well illustrated catalogue of 412 pages has been received from Eugene Dietzgen Co., Chicago, descriptive of the very complete lines of drawing materials and surveying instruments manufactured and imported by this firm.

"Track Laying on the Williamsburg Bridge," has just been issued by the Ingersoll-Sergeant Drill Co., New York. It is a reprint from the Engineering Record, with illustrations showing the part played by pneumatic tools in this construction.

Magnetic accelerators and couplings are described and illustrated in a 16-page catalogue issued by Cutler-Hammer Clutch Co., Milwaukee, Wis. The advantages of these accelerators and clutches over former designs are well brought out.

The American Steam Gauge & Valve Mfg. Co. are sending out their catalogue describing indicators made by them. This booklet contains much useful information, as well as description of their manufacture. It contains 66 pages, and is well illustrated.

Chicago Pneumatic Tool Co. have just issued a 29-page catalogue describing their new pattern Type G Franklin Compressors, and besides containing complete data of the different capacities give description of the new points embodied in this compressor.

Circulars No. 1110 and 1109 have been received from the Canadian Westinghouse Co., Limited, Hamilton, describing their "Catenary Line Construction and the Single Phase Railway System," recently brought to such a high state at the hands of the Westinghouse engineers.

Lifting magnets and the many uses to which they may be applied are fully set forth in a neatly illustrated catalogue issued by the Electric Controller & Supply Co., Cleveland, Ohio. These magnets have but recently been placed on the market, and are meeting with general success.

Pumping machinery is described and illustrated in a bulletin issued by the Smart-Turner Machine Co., Hamilton, Canada. This bulletin contains tabulated data regarding the different types of pumps manufactured by the company. Copy of this may be had on application to the above firm.

Smooth-On, manufactured by the Smooth-On Mfg. Co., Jersey City, N.J., is discussed in connection with its many methods of application in manufacturing and industrial uses. It is an iron cement that seems to have a wide range of possibilities, and will no doubt be largely used. The catalogue contains 96 pages, and is well illustrated.

Catalogue No. 62, issued by William T. Comstock, 23 Warren street, New York, contains 96 pages devoted to books published or imported and sold by them. It includes architectural, scientific, industrial, and technical books of a wide range. To any interested in books of this class this catalogue will prove interesting and valuable.

The Lombard Governor Co., Ashland, Mass., have sent Bulletins Nos. 100, 101, 103, 104, 105. These illustrate and describe the methods and adaptations of their electric speed controller, hydraulic relief valves, type N governor, as well as their new manufacturing plant at Ashland, and a description of the official award granted this company by the Jury of Awards at the Louisiana Purchase Exposition.

The Norman W. Henley Publishing Co., Nassau street, New York, have recently issued a 20-page list in which is fully described all their recently issued books. They comprise a list of self-instructing practical books, of interest and value to the engineer, the superintendent, the foreman, the mechanic, electricians, and other artisans. A copy of this catalogue will be sent to any address in the world upon request to the above company.

BOOK REVIEWS

"Mechanics Problems," by Frank D. Sanborn, professor of civil engineering in Tuft's College, New York. The Engineering News Publishing Co. Cloth, $1.50 net. A book of problems for engineering students, the examples being taken from actual engineering experience, and as such form a valuable adjunct to the books of this class already published. In many cases diagrams are given to simplify the solution, the whole being an acceptable addition to the library of not only engineering students, but the practising engineer.

"The Technique of Mechanical Drafting," by Chas. W. Reinhardt, New York. The Engineering News Publishing Co. Price, $1 net. No draughtsman who desires to be in the foremost rank of his profession, or ambitious student of drawing, can afford to be without a book of this kind. It is clearly and concisely written, contains splendid diagrams throughout, and leads the student of it to a higher plane in connection with mechanical draughting.

"Who's Who?" published by A. & C. Black, Soho square, London, Eng. Price, 10s. Contains over 17,000 biographies of prominent people in the British Empire, every one of which has been submitted for personal revision. It is an authority along this line.

"Who's Who Year Book," published by A. & C. Black, Soho square, London, Eng. Price, 1s. Is made up of the tables which were formerly the feature in Who's Who. These tables were the original nucleus of the latter book.

"The English Woman's Year Book and Directory," by Emily James. Price, 2s. 6d. net. Published by A. & C. Black, Soho square, London, Eng. This book is within itself a bureau of information for women, whether in business or domestic life, and contains much that would be appreciated by all classes.

"Cement and Concrete," by L. C. Sabin, B.S., C.E., assistant engineer, Engineer Department, U. S. Army, New York; McGraw Publishing Co. Cloth, $5 net. No book of recent years has appeared at a more opportune time and with a greater possibility of being appreciated than "Cement and Concrete." It comes at a time when the engineering profession, manufacturers and contractors are keenly alert for literature on the subject, and is presented in a manner to be of greatest value. The subjects dealt with in connection with cement are its classification and manufacture, and its properties and methods of testing, which take up parts one and two of the book. Part three deals with the preparation and properties of mortar and concrete, and part four the uses of mortar and concrete.

"Gas Engine Design," by C. E. Lucke, Ph.D., Mechanical Engineering Department, Columbia University, New York. D. Van Nostrand Co. Price, $3 net. In this book are presented the principles underlying the design of gas engines, together with data for the use of those engaged in building such, or who are connected or interested in same. It is divided into three parts, the first treating of power, efficiency and economy; second the data and method for determining the stresses in the parts and the number and arrangement of cylinders necessary, while the last part is entirely concerned with the dimensions of the parts to resist the stresses. Subject matter is treated theoretically, and the designs and formulas are worked out from first principles.

"Hand Book on Engineering," by Henry C. Tulley, engineer, and member board of engineers, St. Louis. Published by H. C. Tulley & Co., St. Louis. Price, $3.50. This book is in its fourth edition, which has been revised and enlarged, showing the popularity it has attained. The author's experience extends over twenty-five years, so that his ability to write such treatise on the practical care and management of dynamos, motors, boilers, engines, pumps, hydraulic machinery, refrigerator machinery, and all classes of steam engineering is unquestionable. This book should prove of great value to all interested in the subjects named.

"Electrical Transmission of Energy," by A. E. Abbott, C.E., New York. D. Van Nostrand Co. Price, $5 net. This is the fourth edition. It contains 675 pages of valuable matter relating to the subject of the design and operation of electric circuits, together with a large number of special illustrations. It embodies the latest practice known in electrical engineering, and discusses the subject most thoroughly.

"Modern Machine Shop Tools," by W. H. Van Dervoort, M.E., New York. Norman W. Henley Publishing Co. Price, $1 net. Herein is contained a practical treatise describing in every detail the construction and operation and manipulation of both hand and machine tools. The reading matter is of the most practical kind, calculated to benefit the operating mechanic and increase his knowledge in the arts of turning and boring, planing operations, milling, drilling and grinding. This book contains 552 pages, is very fully illustrated, and its perusal should prove an inspiration to the machinist.

"Properties of Steel Sections," by J. C. Sample, C.E., M. Arch., New York. McGraw Publishing Co. Price, $2 net. The book, comprising tables of calculations in the design of structural steel, includes tables of moments of inertia and radii of gyration, of built sections, besides examples of sections, unit stresses, safe loads, girder design, etc. The reading matter is only sufficient to explain their application, the actual tables being the feature. It is without doubt a valuable book to the designer, engineer, architect or contractor.

"Mining Operations in the Province of Quebec for the Year 1904," by J. Obalski, Inspector of Mines; issued by the Department of Lands, Mines and Fisheries, Quebec. Subject of the development of mining resources of Quebec is described. The output of the different minerals is mentioned, together with geological conditions of some of the mining districts.

"Development of the Lake Superior Copper Mines During 1904," by Arthur L. Carnahan, Mining Editor of the Daily Mining Gazette, Houghton, Mich. Published by the author; price 50c. The different copper mines of the Lake Superior group are described briefly, the whole giving a comprehensive description of the copper development in that district.

"Condensation of Exhaust Steam by Means of Saturated Air," by Arthur Pennell, Kansas City, Mo. Treatise on the use of saturated air for steam condensing, together with description of apparatus for that purpose.

"British Progress in Municipal Engineering," by Wm. H. Maxwell, A.M. Inst. C.E., London. Archibald Constable & Co., Limited. Six shillings net. This volume contains 182 pages, the reading matter in large, clear type, profusely illustrated with views and diagrams. In lecture one is taken up the general progress and development of sanitary science, together with the principles of road engineering and maintenance. Lecture two deals with sewerage and main drainage, sewage disposal and the disposal of domestic and trade refuse of towns. Part three discusses water supply systems in considerable detail. The subject matter in this book deals with the latest practice in British municipal engineering, in which is given many illustrations and examples that should be worthy of being followed by engineers the world over.

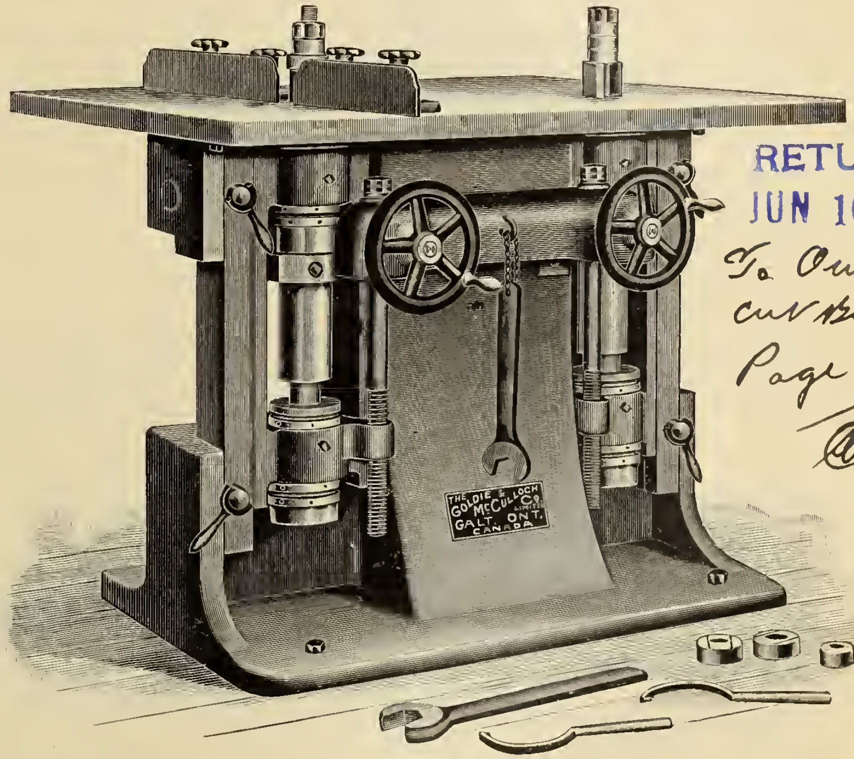
Machinery Development

Metal Working ***Special Apparatus*** ***Wood Working***

COLUMN SHAPER.

THE illustration herewith is a column shaper with drop heads, a new machine made by the Goldie & McCulloch Co., Limited, of Galt, Ont. This machine is suited for doing heavy shaping of all kinds in hard or soft woods. The frame is cored throughout and is of heavy build. The spindles are of best hardened steel. They are 24 inches from centre to centre. The bearings are bronze and have adjusting nuts top and bottom and take up lost motion. The spindles run in oil in bronze steps. The heads will drop down below top of table if desired. These are worked by hand wheels. This is a decided advantage when operating only one head. One set of plain cutters goes with each machine. The housings are heavy, cast in one piece and firmly gibbed to the frame. They are operated with a hand wheel and screw. The countershaft, which is not shown with the cut, has carrier pulleys arranged so that belts run to spindles horizontally. The fast and loose pulleys are 10 inches in diameter by 6-inch face. Speed 1,300 revs. per minute. The floor space required is about 4 feet 6 inches by 3 feet 6 inches. Weight about 1,800 pounds.

Anyone interested in wood-working machinery should write to the Goldie & McCulloch Co., for one of their complete catalogues in which they will get a full description of this machine as well as many other lines that they manufacture.



Column Shaper.

AIR-HARDENING TOOL STEEL.

USING special tool steel has very rapidly become an universally accepted idea. With the increase in efficiency of the modern machine tools, developing at the same time more power and more speed, the necessity for a high grade of tool steel has given this industry such an impluse that to-day there are a great many different plants producing various grades of high class steel.

Attention has been called to the exceptionally good tests that have been made in Canada on the Edgar Allen air hardening steel, by the largest consumers of high-speed steel in this country. The main trouble seems to be that ordinary machine tools are not sufficiently rigid or strong enough to get the best results out of the steel. The result is going to be that heavier and more rigid machines will, in future, be called for when there is heavy work to be done.

Edgar Allen & Co. have installed several plants on the continent, in India, and elsewhere, and are at present installing a plant in Japan for the manufacture of their special steel.

The ordinary tool steel forms but a small proportion of the output of these plants. Steel castings for dynamos, motors, engine frames, locomotive steel centres, cross heads, together with a large class of maganese steel for tramway work, are being marketed in all parts of the industrial world.

Quality, and not price, is becoming more and more essential, and the quality of Edgar Allen steel is so universally recognized that some twenty plants are now producing their special steel, and paying a royalty to the Sheffield office for every pound manufactured. The Japanese Government, as above stated, is the latest to install one of these plants.

This firm have now, for the first time, sought a market in Canada, and have sent a representative in Mr. Thomas Hampton to make tests and show the advantages of their steel. Mr. Hampton, in addition to being a metallurgist and analytical chemist, is a practical mechanic, and has been conducting some of the tests to which we have referred.

Mr. Hampton's headquarters are at the warerooms of Messrs. Williams & Wilson, 320-326 St. James street, Montreal, with whom Edgar Allen & Co. have made a contract for the handling of their steel. A large consignment of steel and high-grade twist drills has been made to Williams & Wilson, and Mr. Hampton is prepared to demonstrate the quality of the steels and drills by tests conducted personally.

AN IMPROVED LAMP BULB.

David Campbell, electrician, of Vancouver, received last week a Canadian patent on an improved lamp bulb, the construction of which is designed to afford a better reflecting surface for the light from the filament. This result he attains by depressing one side of the bulb within the other part, and by carrying his filament around the inwardly projecting portion. The inwardly depressed portion can be silvered to afford a reflecting surface and as the silvered portion will be exposed to the outside air it will not become excessively heated.

THE LITTLE JAP HAMMER DRILL.

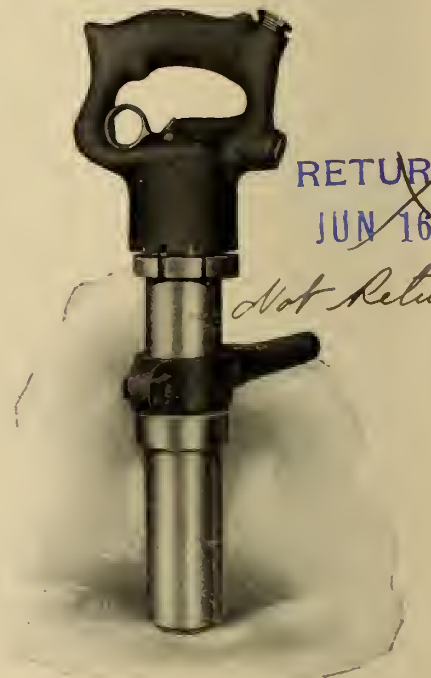
A NEW machine drill has recently been placed on the market by the Ingersoll-Sergeant Drill Co., of New York, which in novelty of design, in wide range of adaptability, and in variety of its uses, promises to at once assume a unique position in the field of rock excavation. The machine has been given the distinctive name of the "Little Jap" Hammer Drill; and while recently introduced, it is in no sense an experience, but has been presented to the public only after the most severe tests in actual service. The device differs radically from the rock drills of standard design. For while the latter are developed from the original churn drill, in which the steel was lifted and allowed to fall against the rock, the "Little Jap" uses the principle of hand drilling, in which the steel remains against the rock and is struck by a heavy hammer. In the new machine, however, instead of a few blows of a heavy hammer, the steel receives many blows of a light and rapidly-moving hammer, the result being far more effective than anything that could be secured by ordinary hand methods.

Drilling Vertical Holes.

Drilling Horizontal Holes.

It is marked by the same distinctive features of design which characterize the Haeseler pneumatic tools built by the same company. Its most pronounced novelty is the use of the Haeseler "Axial" valve, a device the superiority of which has been established beyond question in the arduous service of pneumatic tool work. As its name implies, the "Axial" valve has a movement around a fixed axis or trunnion, the necessary motion in opening and closing the ports being produced by the difference between a constant air pressure on the short wing of the valve and an intermittent pressure on a longer wing. It is thus seen to be a radical departure from the more common forms of reciprocating valves having a straight-line motion. It is a balanced valve in the true sense of the word and its strength of construction, freedom from wear, steadiness in action overcome the defects so common in straight-line valves.

This drill is made in three different styles, adapting it for a variety of service. Numbers 1 aad 2 are intended for



Little Jap Drill.

hand use and are furnished with a hand grip and finger throttle valve. Number 1 has a simple, positive, automatic rotating mechanism mounted in the front head. This style uses solid steels and is intended for drilling pop holes and similar very light work in mine or quarry. It may be operated in either horizontal or vertical positions and uses either a flat, diamond point, or cross bit.

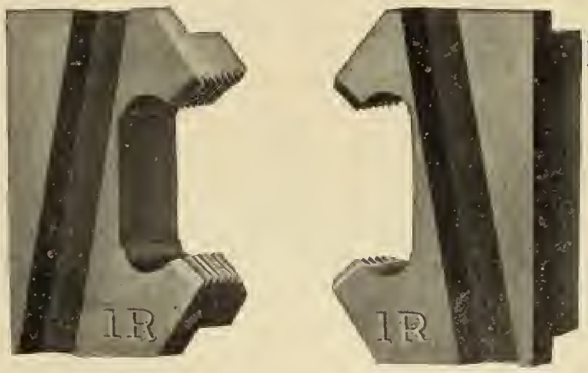
No. 2 "Little Jap" has no automatic rotation, but carries a hand lever by which the entire tool can be swung back and forth through a portion of a circle, thus drilling a round hole. Hollow steels are used with this type through which a portion of the air discharge passes to the bottom of the hole, blowing out the chips and clearing the hole in advance of the bit. To avoid the un-

pleasant effects of blowing the chips out of the hole into the face of the operator, a collar is fixed on the cylinder through which a portion of the air is discharged against the mouth of the hole, throwing the cuttings to the side instead of outward. A further advantage of the hollow steels lies in the fact that the cold discharge air passing through them cools the metal and retains the temper of the bit.

No. 3 also uses hollow steels and has the collar discharge for laying the dust. But it differs from numbers 1 and 2 in being provided with an air power feed in place of the hand grip. The feed cylinder may be mounted on a column, bar or tripod, as in ordinary drill service. Air admitted behind the plunger forces the drill and steel forward against the rock holding them there and feeding forward automatically as the hole deepens. The travel of the feed plunger is 16 inches and a single hose and throttle supplies air for both feed and cutting.

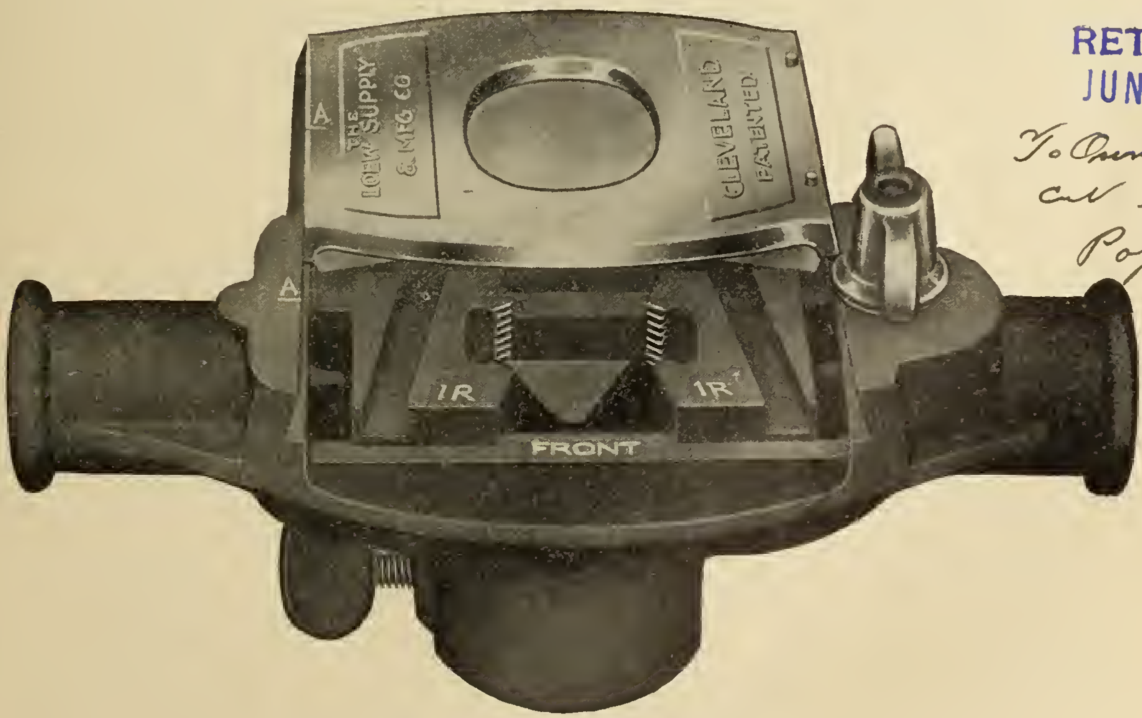
Nos. 2 and 3 are intended for somewhat heavier service than No. 1. They are equally adapted for either hard or soft rock and will drill holes up to a diameter of $1\frac{1}{2}$ inches to a depth of 48 inches. Their performance depends, of course, upon the nature of the material worked in; but in hard granite or quartz a rate of 1 to 5 inches per minute can easily be maintained in a $1\frac{1}{4}$-inch hole; while in sandstone, limestone and similar soft materials, 8 to 10 inches per minute can he easily made. One man with the "Little Jap" can easily drill 150 feet of hole per day, equivalent to the hand work of 10 to 12 men.

"Little Jap" drill steels are made throughout of the best quality of weldless hollow steel. The shank is hexagonal in section, hardened; it slips easily into the front cylinder bushing and is struck by the hardened steel hammer, with no tendency whatever to batter or spread in either element. A rosette-shaped cutting bitt is used and the steels can be re-dressed so long as any material remains. Solid steels of round or cruciform section may be used, where the nature of the material demands it.



Interchangeable Dye.

It is simple, powerful, economical and reliable. It requires no skilled labor to operate it; its compact self-contained construction fits it well for the rough service of rock work. It is especially intended for the lighter demands of excavation, such as putting in plug and feather holes, sinking pop holes, drilling anchor holes, stoping, squaring up, cutting hitches, trimming walls and like work. It is an all-round handy machine, sure to find other unexpected uses. It is a valuable adjunct to the machine equipment of a mine, tunnel or quarry, not only as a rock drill, but also as a pneumatic tool. For with a chisel bit inserted instead of the drill bit, it may be used as a chipping hammer; or by substituting a rivet set it may he used as a riveting hammer in repairing boilers, ore cars, mine buckets, ships and other metal work. As an evidence of the cordial reception which the new tool is meeting, it is interesting to note that the Homestake Mining Co., of Lead, So. Dakota, have 31 of these little machines in service and are adding to the number almost weekly; while they are giving the best service in dozens of other mines and quarries throughout the country.



Loew Stock, with Cam Plate and Dies.

THE LEVY PIPE WRENCH.

The wrench herewith illustrated has many novel features, some of which are not clearly indicated in the cuts. Both

jaws of the wrench are deeply serrated, and the upper jaw is automatically held in its closed position by the compression of a spring on a hinged extension rod at the back of the wrench. The principal novelty of the wrench lies in the fact that it can be operated by one hand, both as to its grasp and its release. It is simply hooked over the pipe with sufficient pressure to overcome the force of the spring, and the relation of the upper and the lower jaw is such that it grips the pipe automatically, holding it firmly with every operative stroke and releasing it automatically with the return. When the work is finished, to release the wrench from its grasp it is only necessary to give a quick backward movement. The sale of the wrench is in the hands of M. K. Northam, Monadnock Block, Chicago, Ill.

A New Wrench.

"LOEW" ADJUSTABLE DIE STOCK.

THE "Loew" adjustable die stock is an entire departure from other tools of this character, for the reason that it is in every sense "adjustable." Its peculiar construction secures for it great strength, adds no excessive weight, and its simplicity and solidity of construction obviates any possibility of derangement.

It is equally adapted to fine threading of brass, steel or iron pipe. When fittings have been tapped over or under size, the pipe can be cut to a perfect fit by a slight movement of the cam-plate either forward of backward. Dies when dull need not be discarded, but can be re-ground on an emery wheel without injuring the thread.

The "Loew" die stock is fitted with either hollow or solid handles, which latter prevent danger or breakage where the handles are screwed into the stock. All parts are interchangeable.

It is impossible to erroneously place the dies as they always centre. They have a large clearance and shearing surface, which prolongs the life of the die and guarantees a clean and perfect thread on iron, steel or brass.

In this die stock the strain of the die is on a line longitudinally through the centre of the handle and through the centre of the cutting surface of the dies, thus binding them against the cap-plate; they are held as rigid as a solid die, insuring a square start and a straight, clean-cut thread.

The dies can be instantly adjusted to the odd sizes of pipe, as there are no set screws to be removed and no wrench required to change the position of the dies.

After the threads are cut, the dies can be instantly released and removed by a twist of the thumb-screw and a slide of the cam-plate. It is not necessary to reverse the tool to free it from the thread; therefore, there is no danger of stripping, or injury to the thread during this operation.

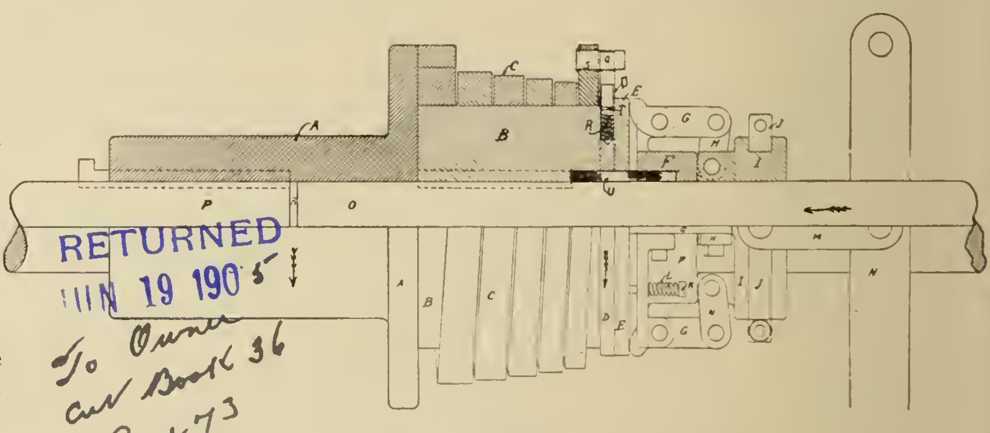
Directions for changing dies.—Turn the thumb-screw until the thumb-nut clears the pins on the cam-plate; slide the cam-plate forward until it releases the dies; remove them and drop the other set of dies in place with figures to front, as indicated by the word "Front" on the stock; slide in the cam-plate until the letter "A" on same is in line with the letter "A" marked on the stock, turn down the thumb-screw and the tool is ready for operation.

DOUBLE-FRICTION COIL CLUTCH.

THE "Double-Friction Coil Clutch" represents a new and scientific method of applying a friction clutch. The following explanation will serve to give at least a fair idea of some of its merits:

In fig. shown reference signs O and P designate the shafts to be coupled, one of said shafts being the driver and the other the driven. In this particular case the shaft P is the driving shaft and O the driven. Keyed on shaft P is hub A and chilled iron drum B is keyed on and rotates with shaft O. Mounted upon hub A is a steel spring C., having one end connected to a flange on hub A; the other end or free end of the coil in this case carries a pin S. Friction plate D is mounted to revolve loosely about the shaft O. A latch is carried adjacent the periphery of plate D and extends beyond the peripheral edge of same, a spring R serving to yieldingly press latch outwardly and beyond the peripheral edge of plate D and into the path of coil pin S, which bears loosely upon latch Q. Upon latch plate D is friction plate E, mounted so as to rotate in unison with shaft O. Keyed to shaft O is a toggle yoke F. Pivotally mounted upon the toggle yoke F are a series of toggle levers and links G and H, and connected therewith is a sliding collar I, mounted to rotate with shaft O.

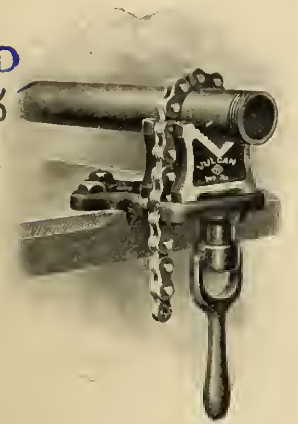
Now, after the careful perusal of the foregoing description of parts you will have secured a mechanical device which operates in the following manner:



Double Friction Coil Clutch.

Commencing with operating lever N, which is attached to extension links M (M is used only when it is necessary to find a convenient place to secure a fulcrum). Without M the lever N is attached direct to operating collar J and held freely to sliding collar I. Link H is attached to sliding collar I, at the inner end and to foot lever G at the outer, which operates on friction plate E,

which in turn bears on latch plate D, causing a friction between the two said plates and the end of drum B. This friction is an auxiliary friction used to retard the free movement of coil C and causing same to tighten gradually and at the will of the operator, thus securing what we call the driving friction between coil C and drum B. You will especially notice the absence of any wood or soft material used in the construction of this clutch. The clutch parts are all housed or incased in an iron casing which is well supplied with oil and is a great advantage, for there is practically no wear on either drum or coil. Another very important feature of this style clutch lies in the fact that a 10-lb. pressure upon the operating lever will produce in the neighborhood of 64,000 lbs. between coil and drum.



Pipe Vise.

There is no known method to-day that can be compared with the coil when used in a scientific manner to secure a perfect friction clutch.

STEAM TURBINES.

That the steam turbine and turbo-generator are destined to be one of the greatest power-developing and distributing factors is evidenced by the number of units of this type which have been installed, and which are now in the process of construction. Owing to the restrictions placed by reciprocating-engine speeds upon the designs of engine-type generating machinery, their dimensions and bulk, as also the cost, have increased enormously in the past few years with the increase in capacity. With the advent of the steam turbine the speeds have increased so as to secure in generator construction minimum bulk and cost consistent with strength and durability.

A striking example of this may be seen in the power equipment of the Rapid Transit Co. in New York. Turbine-type generators with a rated output of 5,000 k.w., weighing 234,000 lbs., run at 750 r.p.m. Generators of the same output driven by reciprocating engines at a speed of 75 r.p.m. weigh 980,000 lbs. Orders for eight turbine generators have been placed with the Westinghouse Electric and Manufacturing Co. in the past few days, mostly for 400 and 500 k.w. units, with one 2,000 k.w. and one 2,500 k.w. machine.

The United Electric Light and Power Co. of New York City have contracted for a motor-generator set consisting of a 1,400 h.p. induction motor and a 1,000 k.w. revolving field alternating-current generator, with automatic regulating control outfit. On the same day orders were received for one hundred and four induction motors varying in size from ½ to 350 h.p., and aggregating 2,200 h.p. capacity.

An order for two hundred and four Westinghouse No. 101-B railway motors was placed by the Transit Development Co., of Brooklyn, and several smaller orders were received for this same motor, and also for the No. 93-A from other companies. The University of Illinois has obtained a quadruple equipment of these motors with two sets of unit switch control for practical demonstration of this system. The nominal rating of the No. 101-B motor is 40 h.p. and of the No. 93-A 50 h. p.

The Pittsburg Reduction Co. will instal two direct-current generators, each rated at 2,200 k.w. at 500 volts. These machines will run at 140 r.p.m., and embody all the latest features of Westinghouse design.

VULCAN CHAIN PIPE VISE.

J. H. Williams & Co., Brooklyn, N. Y., are introducing the Vulcan chain pipe vise, which is illustrated herewith. The vise is claimed to be unbreakable, and it is also compact, requiring almost no space on bench or post; the action is rapid. A quarter inch of chain drop or a quarter turn of screw and the strength of a child will do the work. The grip is positive, non-crushing and always renewable by simply filing the teeth. The chain hugs the pipe half way around. The material is all wrought steel, the parts all warranted are interchangeable.

PIPE-BENDING MACHINE.

It will be noted that the machine is very simple in its construction, at the same time will accomplish a marvelous complexity of work in line of its intended duty. Moreover, demanding the services of an ordinary helper only, who can, with the aid of this machine, bend an amount of pipe to any desired complex curvature in one-tenth of the time that a skilled mechanic would require to perform the same amount of work with the aid of any device now used on the market.

Its light weight renders it extremely portable, thus enabling its being readily carried from shop to job, or vice-versa, and can be secured to any column stanchion, or any available support in a few minutes, or a suitable stand can be furnished, as shown by the illustration.

Piping of steel, iron, brass, copper, or other material can be bent cold up to 2-inch diameter, with one man. This device is indispensable in ship yards, pipe shops, locomotive works, sugar houses, and other places where pipe is used to any extent.

Manufacturers of heating plants, structural and architectural iron, fire escapes, etc., will find this portable pipe bender especially useful; and also is well adapted by having special dies than can be readily attached, for bending light angles, flats, or tee bars to any desired radius as easily as bending pipe. Where pipes are coated by the Sabin process, galvanized, tinned, etc., this machine will bend such pipe to any desired shape without breaking the coating in any way. One man can bend a piece of 2-in. pipe to an S bend in three minutes, no other assistance or device being used, or needed.

The cost of repairs where it has been used 10 hours per day in shipyards, railway shops and other places has been so slight as to be a negligible quantity. The Chicago Pneumatic Tool Co. are prepared to handle orders for this device and make prompt deliveries. It has been thoroughly tested in the navy yards, where the parties in charge of the pipe works have recommended it so highly that they have considered it of the same high quality if their other labor-saving devices and for that reason decided to take up the manufacture and marketing of the same.

Pipe Bending Machine.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

BERLIN and Brantford are negotiating with an American company, represented by H. Rustad, of Cresco, Iowa, who manufacture a malleable stump puller, and also own a large brass goods plant in Milwaukee. All their goods are patented, both in the United States and Canada, and to save the patent from expiring there, they intend to build and operate a large plant somewhere in Ontario, where the two lines are to be made. Mr. Rustad says that the field for their brass goods in Canada is a vast and inviting one, and by manufacturing here the duty would also be overcome. The export trade could also be handled as advantageously from a Canadian plant as from the one in the United States. The firm has just closed an immense order with the Standard Oil people to provide them with brass supplies. That will tax all the energies of the present plants, and is also a reason for them seeking new quarters. They are at present temporarily making some of the lines at Toronto, but it is not likely they will stay there.

A new hospital is to be erected at Moosomin.

A new tanning factory is being erected at Simcoe.

A new fire hall, to cost $25,000, will be built in Toronto.

The Pneumatic Horse Collar Co. may locate at Brantford.

The C.P.R. are to erect a $26,000 station at Revelstoke.

W. White, K.C., is erecting a fine office building in Moosomin.

Sudbury will build a new $15,000 public school this Summer.

The Salvation Army propose erecting a $9,000 barracks at Galt.

A permit has been issued for a new $10,000 school at Vancouver.

Grundy Brothers stove foundry at Strathroy is being enlarged.

The Brunswick Hotel, Winnipeg, is to be re-constructed this Summer.

The Canadian Northern is now running trains to Battleford, Sask.

The Fessenden Wireless Telegraph Co. is seeking incorporation at Ottawa.

D. S. Perrin & Co., Winnipeg, are to erect a new warehouse at Winnipeg.

Cameron, Dunn & Co.'s new handle factory at Strathroy is completed.

The Massey Harris Co. are building a large warehouse at Foxwarren, Man.

A two-storey addition is to be made to Murray's planing mill at Winnipeg.

J. J. Walkley is to erect a $15,000 building on St. Paul street, Quebec.

Bell Telephone Co. is increasing its capital from $8,000,000 to $9,000,000.

The new cement and sand brick plant at Stratford has commenced operations.

Canadian Glue Co. are arranging to build three new buildings at Brantford.

F. Simard & Co., are making additions to a building in Quebec to cost $15,000.

L. G. Wing has awarded the contracts for his new $90,000 theatre at Vancouver.

The Canadian Moline Plow Co. are erecting a $40,000 warehouse at Winnipeg.

The Dyment-Baker lumber factory, burned recently, will be rebuilt at London.

Scott Muffler Co., employing 20 hands, have opened a factory at Niagara Falls.

Belleville Hardware Co. have been compelled to enlarge their manufacturing plant.

New dwellings to cost $150,000 are being erected in St. Thomas, Ont., this Summer.

East Toronto is offering a free site and other inducements to the Maestro Piano Co.

The American Chicle Co. are to erect a $35,000 factory and warehouse in Toronto.

Lake of the Woods Milling Co. are installing an electric plant at their Keewatin mill.

The Dominion Radiator Co., Toronto, are to erect large warehouses and offices in Winnipeg.

The Southwestern Traction Co. intend enlarging their power house at Chelsea Green, London.

A modern business block will be erected on Government street, Victoria, B. C., by M. Promas.

A winding-up order has been issued to close up the affairs of the Canadian Tin Plate Co., Hamilton.

Cockburn Lumber Co., Sturgeon Falls, are to rebuild their broom factory and install new machinery.

Muirhead & Co.'s new elevators at Winnipeg are nearing completion. The plant will cost $25,000.

H. T. Knott has secured the contract to build the new $10,500 warehouse for the Melrose Co., Victoria.

The C.P.R. will construct lines east and west from Saskatoon this Summer for colonization purposes.

Ingersoll has voted a loan of $20,000 to the Ingersoll Nut Co. The new industry will employ 40 men.

The Mason & Risch Piano Co., Toronto, are enlarging their factory and securing additional premises.

A three-storey stone-and-brick block is to be built in Vancouver by Ald. Cook, the cost to be about $20,000.

Clinton ratepayers have decided to loan $6,000 to the Clinton Knitting Co., who will build a new factory.

The Dymond-Somerville Upholstering Co., Strathroy, have doubled their capital and will enlarge their plant.

Port Arthur is endeavoring to secure the proposed western factory of the Henderson Roller Bearing Co.

J. R. Booth, Ottawa, is to establish large pulp and paper mills at Chaudiere in addition to his present plant.

The D. Conboy Carriage Co. will erect a $75,000 factory in Toronto and employ 200 hands to make carriage tops.

Many concerns are looking for sites at Port Arthur as a result of the decision to establish a blast furnace there.

The Hemphill Box Co. have secured premises at Brantford, and will start manufacturing paper boxes at once.

Ingersoll has granted a loan of $25,000 to the Ingersoll Nut Co., who agree to employ 40 men in their factory.

Grimsby has voted $15,000 to the Walker Steel Range Co., who have secured the Grout foundry in that town.

An American typewriter company may establish a factory in Brantford, though as yet no arrangements have been made.

Mr. Lamb, of Bridgewater, N.S., is to install a cyanide process in the Boston and Richardson mine, at Stormont, N.S.

The Dominion Suspender Co.'s factory at Niagara Falls is to be enlarged by an addition 30x85 feet, two storeys high.

The Methodists of Napanee have decided to tear down their old church and replace it with a new one to cost about $20,000.

The Raymond Gas & Engine Co. will locate their works at Port Arthur, Ont., and will give employment to about 200 men.

Ogilvie Flour Mills Co. have secured 1,000 feet frontage on the Lachine Canal and will make extensive additions to their plant.

Standard Windmill & Mfg. Co. have leased the unusued G.T.R. shops at Whitby and will install machinery immediately.

The C.P.R. are to erect four large new depots in Manitoba this Summer at Killarney, Neepawa, Crystal City and Boissevain.

Ker & Goodwin, who are building a new factory at Brantford, and will employ 20 men, are asking for a fixed assessment.

Ottawa citizens have voted by a substantial majority in favor of the purchase of the plant of the Consumers' Electric Co.

An amalgamation may take place between the Hamilton, Ancaster & Brantford Railway and the Brantford and Erie Railway.

Operations are to be resumed by the Millerton Tanning Extract Co. in their mill near Harcourt, N.B. Thirty men will be employed.

D. Hibner & Co., Listowel, will build a $14,000 addition to their chair factory. A fixed assessment has been granted them by the town.

Permits for buildings have been issued at Toronto Junction up to June 1 amounting to $133,500, the number of buildings being 85.

The Canadian Manufacturers' Association is opposing the proposition to spend $10,000,000 in building a tunnel to Prince Edward Island.

Halifax is endeavoring to secure the Bell Hotel Telephone Co. as a new industry. About 25 men would be employed in the factory.

A $1,000,000 company is being floated in Winnipeg to erect a million-dollar arcade. A. & W. Melville, architects, are drawing up the plans.

Work has commenced on the new $100,-000 factory which is being erected by street, Montreal. The factory is to be six storeys in height.

Sandwich is the latest place to claim to be the location of the proposed $10,-000,000 plant of the United States Steel Corporation in Canada.

Geo. S. Deeks & Co. have secured the contract to build the section of the new Toronto-Sudbury C.P.R. line between Bolton and Parry Sound.

The Owen Sound Portland Cement Co. have been awarded the contract for supplying to the City of Winnipeg about 30,000 barrels of cement.

Mr. Whitlaw, of the American Radiator Co., was in Brantford this week closing arrangements for the starting of the new plant in that city.

The Merchants' Rubber Co., Berlin, are erecting a large warehouse addition to their factory. Their staff is to be increased from 170 to 200.

Two storeys are being added to the Gurney-Tilden Co.'s warehouse in Winnipeg, which will make the structure six storeys and a basement.

New buildings will be erected in Peterboro this year by the Canadian General Electric Co., the new stock issue of $1,125,000 having been taken up.

Farmers' Co-operative Harvesting Machine Co., Whitby, are making their first car load shipments of Clokey spring steel hinders to the Northwest.

The Taylor Pattison Mill Co. have been incorporated at Victoria, B.C., with a capital of $50,000, to manufacture doors, sashes, furniture, etc.

A contract has been let by the Ogilvie Milling Co. to a Fort William firm for one million feet of lumber to be used in the construction of the new plant.

The Ottawa Board of Works have awarded the contract for a ten-ton steam roller to Julian Scholl & Co., New York City at a cost of $2,700.

An American company is arranging to take over the unused factory of the Niagara Metallic Co. for the manufacture of harness, axes, and other tools.

Ferguson & Bull, Woodstock, N.B., have purchased the Imperial Packing Co. factory and will install power and increase the output of tubs and barrels.

Krug & Crosbie, machinists, Hamilton, Ont., have perfected a drill chuck which embodies some new features. They intend manufacturing it for the Canadian trade.

A company is being organized at Brantford to manufacture a patent composition roofing, the patent rights for which have heen secured from a firm in Indiana.

The McKie Buggy Co., of Plattsville, have secured a site at Hamilton, and will erect a reinforced concrete building, costing $10,000. Fifty hands will be employed.

The contract for the new steel bridge over the Sauble River, near Allenford, has been given to the Hamilton Bridge Co., and the abutments to D. Keys, of Kincardine.

H. T. Andrews, Orillia, is erecting a metal clad building, 16 x 40 ft., two storys high and will move into the new quarters about July 1st, and occupy it as a tinshop.

Only 95 of the ratepayers of the town of Orillia voted against the by-law to give the James Bay Railway a bonus of $30,000 and the measure was adopted by 500 majority.

The Hunter Blast Furnace Co., of Duluth, is starting operations at Port Arthur. As soon as pig iron is produced a number of new industries will be established.

Brampton and Stratford both claim to be likely to secure a new roofing factory to employ 50 men, and to be operated by the Philip Carey Mfg. Co., of Toronto and Montreal.

The McIntyre block, Winnipeg's oldest and most expensive business location, is going to have four more storeys added to it, thus making it one of the largest buildings in Canada.

The running of the Temiskaming Railway by electricity and the sale of surplus power is provided for by a bill introduced into the Ontario Legislature by Hon. Mr. Matheson.

A quarter of a million dollars' worth of buildings are being erected at Galt. A new foundry, costing $100,000, and a knitting factory, costing a similar amount, are under way.

The contract for the construction of a warehouse in Vancouver for Messrs. Robert Kelly and Frank Burnett, has been awarded to Mr. J. M. McLuckie, the price being about $35,000.

Work has commenced on the erection of the new 3,000-barrels per day flour mill at Keewatin. Storage elevators for 500,000 bushels of grain will also be built by the Keewatin Flour Mills Co.

Fort Frances is opposing the proposition that electrical power be generated on the Canadian side and used to develop industries across the border. A strong deputation visited Ottawa last week.

The Minister of Railways has awarded a contract to the Dominion Iron and Steel Co. for the supply of 25,000 tons of steel rails for the Intercolonial; delivery to be made between now and October.

The Canadian Meter Co., formerly of Windsor, have let the contract for an $11,000 factory, to be built in Hamilton. The building will be a three-storey brick, 40 x 100, and 50 men will be employed.

The Chatham, Wallaceburg & Lake Erie Electric Railway has chosen W. N. Warburton as its general manager. Construction will be proceeded with at once, and the line completed in four months.

It is proposed to build a spur-line of the D.A.R. railway in Nova Scotia to Canning. The route has recently been surveyed by Engineer Rand, of Canning, and work is to be terminated at an early date.

Officials of the Dominion Iron & Steel Co. say that the steel rail plant at Sydney will be producing rails inside of another month. Within a year the full capacity of 1,000 tons per day will be turned out.

The Standard Coal & Railway Co. are stated to have struck a large seam of coal on their property at Half-Way River, Cumberland County, N.S. At a depth of 2,350 feet the thickness is from eight to ten feet.

A music hall, costing $50,000, is to be erected at the rear of the Windsor Hotel and facing Cypress street, Montreal. Mr. M. Rodden, of J. J. Browne & Son, is the architect, and he expects to have the new building completed by September 15.

The Pender Nail Works, St. John, N.B., have completed plans for their new mills. Besides a new wire mill, 60 x 100 feet, the plans include a cleaning house, rod warehouse, boiler and engine rooms, and coal shed.

The Winnipeg Supply Co. have purchased from Allis-Chalmers-Bullock, Limited, Montreal, a complete crushing plant for their Stonewall works. It includes a No. 4 "K" Gates crusher, screens, elevators, etc.

The Fensom Elevator Works, on Duke street, Toronto, have been purchased by the Capewell Horse Nail Co., who purpose using the premises for manufacturing purposes. The price paid was in the neighborhood of $40,000.

A company to be known as the British America Coal & Railway Co. has been organized in Sydney. The object of the company is to develop a number of coal areas in Cumberland County and other parts of Nova Scotia.

The Volta Electric Repair Works have completed the installation of new alternator, exciter and switchboard at W. C. Harrison's electric light and power station at Norwood, Ont., which was burned out some weeks ago.

The Imperial Steel & Wire Co., Collingwood, Ont., will double the capacity of their plant which will be 50 tons minimum of finished wire products daily. Additional machinery, engines, boilers, etc., will be ordered at once.

The dredge King Edward is working alongside the new canal wall built a year ago at Cornwall, and will excavate the entrance to the old canal to a depth of fourteen feet, to allow vessels of deep draught to enter the dry dock.

The Americans are to have competition in the Montreal market for anthracite coal. There is a steamer on the way out from Wales with a cargo of 4,500 tons of anthracite. The coal is to be delivered partly at Quebec.

The contract for a new elevator has recently been let by the G.T.R. to E. R. Baker Co., of Chicago and Midland, to be built at the latter place. It is to have a capacity of 1,000,000 bushels and to be ready for this year's western crop.

The installation of machinery tools at the new works of the Canadian Westinghouse Co., Limited, Hamilton, is practically completed. Preliminary manufacture has commenced, and in a few weeks the company expects to be running full blast.

A number of hematite iron claims in the vicinity of Quatsino Sound, Vancouver Island, have been, or are about to be, disposed of to American capitalists, and there are prospects of blast furnaces being established somewhere on the Island.

The Colchester Coal & Railway Co., Colchester, N.S., have asked the municipality for exemption from taxation and for a small grant towards the purchase of a right of way for railway from the Intercolonial line to their mines.

The report of the building inspector for Montreal shows that building operations for the month of May amounted to $1,062,348. The value of new buildings put up was $963,662, as compared with $664,395 for the same month last year. Permits were given for 156 houses, containing 257 dwellings, 4 stores, 1 ware-

house, 6 factories, 1 school and 1 apartment house.

The Ontario Government have appropriated $465,000, to be expended on necessary buildings in connection with the University of Toronto, including a new General Hospital, a physics building, a convocation hall and a museum for the science building, etc.

Steel cars will soon be running on some of the surface lines in New York. The first lot of a large number ordered has been received and will be put into service at once. Wood is used only for inside trimmings and even this is supposed to be fireproof.

The Intercolonial Coal Co. have placed an order for eighty thousand red bricks for their fire-brick ovens with the Sylvester Brick Co., and the Dominion Iron & Steel Co. have placed an order with the Intercolonial Coal Co. for thirty thousand fire brick.

The Giant Grip Horseshoe Co. are making arrangements to establish a branch factory at Port Arthur. From 20 to 40 hands will be employed to commence with. The company's main factory is at Duluth, but they also have a branch at Little Falls, Minn.

Guelph Foundry Co. have submitted a proposition to the city which, if accepted, will mean the abandonment of their present premises and the erection of a brick and steel factory, 600 x 60 feet. Their pay roll will also be increased from $75,000 to $125,000.

Messrs. Penniman & McGuire, Providence, R.I., have commenced work on the large dam of the Koochiching Power Co., at Fort Frances, Ont. It is estimated that the works will consume 100,000 barrels of cement, and that the total expenditure will exceed $3,000,000.

Fort Frances has purchased a double cylinder Nott fire engine, three hose reels and chemicals and 2,000 feet of hose from the Winnipeg Rubber Co. Glenboro and Prince Albert have also purchased hose and reels, while Regina is also improving its fire equipment.

Taylor-Forbes Co., Limited, Guelph, have nearly completed the installation of an electrical power plant with 250 kilowat generator and seven motors, costing $12,000. Their new foundry for manufacturing radiators is 348 feet long by 80 feet wide and 125 men will be employed.

Under directions of Hon. Mr. Foy the Bureau of Mines has made arrangements for carrying on during the present season a systematic exploration of certain portions of New Ontario, including both mineral-bearing regions and districts believed to be more agricultural in their character.

The steel rail plant at Sault Ste. Marie has filled an extensive order for 80-pound rails for the Canadian Pacific Railway, and is now turning out 100-pound rails for the Michigan Central for use on their Canadian lines. These are the first rails of this weight made by the company.

West Kootenay Light & Power Co. is to establish a plant at Upper Bonnington Falls, to cost $1,000,000, and to generate 24,000 horse-power for use in Grand Forks, Phoenix and Greenwood, in the Boundary Country. The plant at the lower falls already generates 4,000 horse-power.

The Owen Sound Iron Works, Owen Sound, Ont., have completed three coal hoppers for the Shallow Lake Cement Works. They also have ready for shipment to Lakefield, Ont., a rotary cooler and pump, three elevators, three coal hoppers and smokestack for the cement works there.

Walter M. Lowney, chocolate manufacturer, Mass., is to establish a large factory at Montreal, Canada, to consist of a main building, 55 x 100 feet and six storeys, with a two-storey ell 27 x 100 feet, in which will be installed the boiler, engine, electrical machinery and refrigerating plant.

Windsor has defeated by-laws to grant exemptions from taxation and free water for ten years to the Standard Paint and Varnish Co., the Peninsular Tool Co., the Norris Kollar and Kuff Co., and to raise thirty thousand dollars by debentures to improve the city lighting plant.

The Imperial Steel & Wire Co., of Collingwood, are about to double their plant, which has been running night and day since they started in February. They are adding new boilers and engines and will be in the market for new machinery. They expect to turn out 50 tons of wire per day.

Arthur P. Holden, machinist, Adelaide street west, Toronto, intends adding to his premises the flat immediately above that now occupied by his shop. When the new space is occupied he will have practically double his present capacity and will add considerably to his equipment of machine tools.

The Union Twist Drill Co., mention of which was made in last issue, have been recently organized by men prominent in the twist drill business. They propose to build an addition to their plant 60 x 180 feet at Athol, Mass. The new shop will be used as a smith shop, hardening and stock room.

It is now possible for three men, working with hand machinery, to make 3,000 cement bricks a day. A recently-invented machine, employing five men besides those who mix the cement, will, its inventor asserts, make 6,000 bricks an hour. A big company is forming to place the machine on the market.

The Morris, Baird Co., of Victoria, may establish a branch at Vancouver. Mr. Baird, of the firm, has spent several days here, looking over the ground. The firm manufactures polishes of all kinds for leather, metal or wood, and makes ink and paint as well. The raw material used is brought from Port Renfrew on the northern coast.

The Dominion Coal Co. are not likely to send any coal to Sweden this year, as they have been doing for several seasons past. This is owing to a break in the contract between the Dominion Iron & Steel Co., and the Johnson Line of steamers by which the latter boats were to bring Swedish ore to Sydney as return cargoes.

Messrs. F. L. Wanklyn, J. P. Dawes and Henry Joseph have been appointed a committee of the Windsor Hotel Co., of Montreal, to visit the United States and inspect all the latest and most modern structures of the kind in that country. This move has been taken in view of the early construction of the annex to the present building.

The rail mill of the Dominion Iron & Steel Co., at Sydney, has undergone a test, a dummy billet of lead being used for the purpose. The engines were found to work satisfactorily, but the adjusting of the machinery will require some time. The blooming mine resumed operations after being idle three or four weeks due to an accident to the main engine.

It is stated that the Dominion Coal Co. have decided upon the adoption of shearing machines in their mines at Glace Bay, N.S. With these appliances coal can be mined with the use of less powder than is required to blow down coal cut by ordinary mining machines, with the result that a larger percentage of the product reaches the surface in lump form.

The Chatham, Wallaceburg and Lake Erie Railway Co. are building a new line of electric railway from Chatham to Wallaceburg, Ont., a distance of about twenty miles, through a rich farming and fruit-raising country. An order for four double equipments and one quadruple equipment of No. 101 railway motors has been placed with the Canadian Westinghouse Co., Limited.

The official announcement is made that the locomotive plant of the Locomotive & Machine Co. of Montreal, has been increased so that it is now able to turn out 10 locomotives a month, or 120 a year. There are now orders on hand for 100 locomotives. The structural steel plant is being increased sreadily and it is intended that it should finally have an output of 1,000 tons a month.

The Eckardt Casket Co., and the Eckardt Silver Plate Co. will remove from Toronto to Brampton in the near future. The building of an electric railway and the development of a large electric power at Erindale, about twelve miles from Brampton, will result in the latter town's being able to offer exceptional advantages in the way of cheap power and lighting to locate there.

The Dominion Iron & Steel Co.'s blooming mill is again in operation, and the rod mill also resumed work this week. Worv was started a few days ago on the excavations for fifty new coke ovens, which the company propose to build. These ovens will be the same as the ones already in use, and fifty built some time ago, which were found to be unsatisfactory, will be changed to bi-product ovens.

The Iron Mountain group of twenty-two claims of hematite iron, on the west arm of Quatsino Sound, Vancouver Island, have been purchased for $75,000 by J. A. Moore and William Piggott, of Seattle. The purchasers are in negotiation with prominent Eastern Canadian capitalists and contemplate the establishment of blast furnaces, involving an initial expenditure of $100,000, contiguous to the ore supply.

The zinc plant built by the Kootenay Ore Co. at Kaslo last Winter is now in operation. The building, 80 by 75 feet, adjoins the same company's sampling plant, and is so situated on the steep banks of Kaslo Bay that the ore is received from the railroad cars at the top and is delivered to the steamers beneath, with the assistance of gravity to reduce the handling required during the process of treatment.

At the late session of the Nova Scotia Legislature an act was passed incorporating the Pictou Smelting Co., for the purpose of utilizing the copper smelting furnace erected at Pictou a year ago by the Crown Copper Co. There are those who think that Nova Scotia presents an interesting field for the erection and development of a large

smelting and refining business, due to the fact that she has abundance of coal.

The cities and towns of the Canadian Northwest are growing rapidly, and the demand for water and gas pipe is increasing so much that the Canada Foundry Co. have decided to erect a new plant at Davenport, to take care of the increasing business. It can be put up in about ten weeks, and will cost about $75,000. The foundry is shipping a lot of steel to Welland for the new works of the Electrical Development Co.

The Westinghouse Air Brake Co. have just received orders from the Baltimore & Ohio Railroad System for the equipment of 10,000 of their cars with Westinghouse friction draft gear apparatus. This will now make a total of 25,000 cars on this system equipped with the friction draft gear device. It is interesting to relate in this connection that the Pennsylvania system has now a total of 70,000 cars equipped with this same device.

Canadian exports of lumber to the United States have grown very greatly during the pase five years. The value of the exports of wood and the manufactures to that country in 1898 was $9,840,524, and in 1903 it had risen to $18,823,878, an increase during that time of $8,983,354, or something like 90 per cent. The total exports to all countries in 1903 amounted to $40,742,641, an increase of $5,567,167 over that of the previous year.

Combines are said to have been formed in British Columbia to control the lead smelter and shingle mill industries. the Trail, Hall mines and Marysville smelters are understood to have got together to capture the lead trade in the orient from the Australian and British producers. Ninety per cent. of the shingle mill men have gotten together and organized companies to handle the local and export trades, also agreeing upon prices to be quoted.

The Sydney Foundry & Machine Works Co. are to make large improvements this year. An office building is now being erected, and an addition will also be made to the machine shop, besides erecting new blacksmith and boiler shops. A large amount of new machinery will also be installed. The works are now doing some heavy steel plate work for the dredge Cape Breton, and are also casting the pillars for the new I.C.R. station at Sydney, N.S.

There is every belief that a large paper mill will shortly be established at Port Hope. The company looking for this site have taken up the matter, and it is anticipated that arrangements will be carried out before the final establishment of the industry in that place. It is proposed to install a large amount of expensive machinery that when running will employ about seventy-five hands. The company have orders ahead to warrant their running the mill night and day for some time.

The Canadian General Electric works at Peterboro have just turned out the largest generator ever built in the world. It is of 12,000 horse-power, and is built for the Toronto and Niagara Power Co. The next largest was manufactured in Pittsburg by the Westinghouse Co. for the Ontario Power Co. The Peterboro works is now equipped to build the largest and heaviest class electrical machinery. Several more of these 12,000 horse-power generators will be built at Peterboro.

To take care of its rapidly-increasing business, the Hamilton Cataract Power, Light and Traction Co. are making extensive additions to their power plant at De Cew Falls. Orders specifying prompt delivery have been placed with the Canadian Westinghouse Co., Limited, for the following apparatus: Two 6,400 k.w. three-phase, 2,400-volt, 8,000 alternation, 287 r.p.m., two-bearing generators with motor-driven exciters and switchboard apparatus; four 3,200 k.w. oil-insulated, water-cooled raising transformers.

The Globe Refining Co., with works at Fort Elmsley in Lanark County, have again resumed active operations. They have secured all the important graphite properties in the vicinity of their refinery thus insuring a large and extensive supply of ore. This industry has seen little activity in Canada heretofore, but with the splendid deposits and up-to-date equipment of this company a large quantity of high-grade material will no doubt be placed upon the market. The company is capitalized at $300,000.

The C.P.R. has closed a contract for the construction ot 45 miles of road from Spencer's Bridge on the main line, 180 miles east of Vancouver, to the Nicola Coal Mines, following up the Nicola River. This road is the commencement of the proposed road to Midway, some 200 miles from Nicola Mines, and no doubt this further extension will soon be built. The Nicola Valley embraces a fine ranching and fruit growing country, while the importance attached to the development of the coal mines at Nicola is considerable.

The Standard Coal & Railway Co. are stated to have struck a large seam of coal on their property at Half-Way River, Cumberland County, at a depth of 2,350 feet, the thickness is from 8 to 10 feet, but as the company has been using a jump drill, it has not been possible to have a core. Mr. Fletcher calculated that the coal would be reached between 2,500 and 3,000 feet. The location of the bore hole is supposed to be the centre of the basin. This strike of coal is one of the most important made in Nova Scotia for years.

The Ontario Wind Engine & Pump Co., Toronto, have just received a rush order for two Canadian air motor outfits from Paris, France, and in speaking of the previous shipments the agent states as follows: "Have just finished erection of 12' air motor sent me last Fall. This outfit is a remarkable one. It is on the bank of the Mediterranean Sea, Monte Carlo. It pumps water from a river and elevates 180 ft. to distance of 1,275 ft. The result is magnificent, and it is a complete success. The two present outfits go to Marseilles."

The Canada Steel Goods Co., Limited, of Leamington, Ont., has decided upon the removal of its plant to Hamilton, where a large factory site has been purchased adjoining the Canadian Drawn Steel Co.'s factory. The company will at once erect a building 250 feet by 80 feet. This company has recently purchased some other manufacturing concerns in other parts of Ontario, and it is its intention to consolidate them and bring the entire plant to Hamilton. All classes of high grade stamped steel goods are manufactured. A working staff of 75 or 100 will be employed.

The proposed Michigan Central tunnel under the Detroit River will be two miles in length. Twin tubes will be laid beneath the river in the one subway. Electric traction will be the motive power used. An extensive power station will be erected on the Detroit side. The locomotives used will be about 7,500 h.p. each. Each tube will have a single track, using the third rail electric system. The entire work of construction will be done from the Windsor side, the offices of the company being located there. The supposed cost of the tunnel is about $7,500,000.

Toronto is experiencing a remarkable stimulation in the building industry, and up to the present time the amount of money spent in new buildings is double the amount spent last year during the same period. Following are the figures as to the value of buildings for which permits were issued by Commissioner McCallum-

	1904.	1905
During May	$554,956	$1,104,154
Jan. 1 to May 31.....	1,525,063	3,191,112
Permits during May.	172	311
Jan. 1 to May 31....	706	914
Buildings erected from Jan. 1 to May 31....	526	1,078

A new system of steel tie construction is being exploited in Pittsburg and negotiations are pending for the adoption of the new ties by two railroads entering this city. The new design is made on the principle of a continuous truss for all portions of the roadbed. The ties are arranged in triangular order, each firmly clamped to the rails, which are connected in pairs by means of bolts. A perfect truss thus is formed. The wide spaces between the extended parts of each triangle are occupied by short ties, and the entire structure is so put together that regular distances between the centres of the ties under the rails are maintained.

The Windsor & Tecumseh Electric Railway is to be equipped with 300-k. w. 3,300-volt Westinghouse single-phase engine type generators direct coupled to Robb-Armstrong engines, and its car equipments are to consist of two 50-h. p. Westinghouse single-phase motors each. As this is the first single-phase road in Canada, its development will be watched with considerable interest. One of the advantages of this equipment for short interurban roads is the elimination of feeders, sub-stations and raising transformers. The generator voltage is fed directly to the car through the trolley wire and step-down transformers are carried by each car.

In the matter of electric lighting, the towns in the Northwest are showing the enterprise which characterizes them in everything else. The Town of Calgary has just awarded the Allis-Chalmers-

Bullock, Limited, Montreal, the contract for a complete civic lighting plant. The current will be generated by a 260 k.w. alternating-current generator of the Bullock engine type, of slow speed. The contract includes, besides the generator, a switchboard, three 35-light 6 6-10 ampere arc light circuits and all the wiring necessary for the commercial circuits, thirty lighting transformers, pole line, etc., etc. The work will be begun at once.

Work will be begun shortly on the new plant which the Simplex Railway Appliance Co., of Canada, will erect at Lachine, Que. The new plant will be more than double the size of the present structure at St. Henri. The machinery in use at St. Henri will be moved to Lachine, and the compamy will shortly be in the market for considerable equipment in the way of machine tools. All contracts will be placed by the mechanical department at St. James and Rose De Lima Streets, Montreal. The Simplex bolsters, side bearings, break beams and structural steel used in the construction of steel cars will be manufactured in the new plant.

The Homestake Mining Co. has adopted pneumatic haulage for its gold mines at Lead, S.D., and has just placed an order with the Ingersoll-Sergeant Drill Co., for a mammoth duplex four-stage Corliss air compressor, to supply the power. Although the Homestake Mine contains low grade ore, it has proved the richest in the world, paying out nearly $20,000,000 in dividends. This has only been made possible by the adoption of the most improved methods and the installation of machinery giving every possible economy. This question of haulage has only been decided after thorough and complete tests extending over a period of more than a year.

The Newcastle Portland Cement Co., of Newcastle, Pa., have placed an order with the Westinghouse Electric & Manufacturing Co. for two 175 k.w., three-phase, alternating-current generators, two 42 k.w. exciters, and the necessary switchboard for the control of this apparatus. These machines will supply current for operating a number of type C induction motors, ranging from 10 to 100 h.p. each, which were also included in the contract. The Western Engineering & Constructing Co., through the San Francisco office of the same company, ordered 180 h.p. in type F, variable speed, induction motors, 130 h.p. in type C constant speed induction motors, and four O. D. transformers.

It is reported that the control of the Canadian Tin Plate and Sheet Steel Co. has passed into the hands of J. W. Allison and G. H. Meldrum, of New York, and that with the co-operation of Montreal and Toronto capitalists manufacturing will be undertaken at Morrisburg, Ont. If the plans materialize a large plant will be erected and the company reorganized with a capital of $1,500,000. Thomas Davidson & Co., of Montreal, manufacturers of enamelware, are said to be interested. Work should begin next October. Raw material will be furnished in bars from Sydney. John Main, vice-president of the Polson Iron Works, and W. K. George, president of the Manufacturers' Association, are said to be interested.

American radiator Co., known as the Radiator Trust, has purchased the Cockshutt factory at Brantford, and will take immediate possession. Alterations of an extensive character will be made and a modern plant installed, the company intending to employ 200 hands and endeavor to capture the Canadian market. The company is an amalgamation of the former American Radiator Co., of Illinois, which controlled one-half of the radiator business of the United States; the Titusville Iron Co., Pa.; the St. Louis Radiator Co., St. Louis; the Standard Radiator Co., of Buffalo, and the M. Steele Co., of Springfield, Ohio, the capital being $10,000,000. Not content with controlling the United States trade, the company now seeks to hold its Canadian trade, which has suffered considerably under the dumping clause.

For some time rumors of an amalgamation of the leading rubber-manufacturing concerns in Canada have been heard, and the charter granted to the Commercial Rubber Co. of Canada is considered proof that the merger is well under way. The provisional directors of this new company are as follows: Sir Montagu Allan, president of the Canada Rubber Co., Montreal; S. H. C. Miner, president of the Granby Rubber Co.; H. D. Warren, president of the Gutta Percha & Rubber Co., of Toronto; James Robinson, president of the Maple Leaf Rubber Co., of Port Dalhousie, and ex-Ald. C. F. Smith, D. Lorne McGibbon, general manager of the Canada Rubber Co.: and E. A. Wright, secretary-treasurer of the same company, are named in connection with these respective positions in the new company. The purpose of the company, as stated in the application for incorporation, is to buy the property of the defunct Boston Rubber Co., of St. Jerome.

Recent surveys have brought to light much more advantageous routes for the new proposed Georgian Bay canal than were heretofore entertained. It is now thought possible to build the canal for $70,000,000 instead of $100,000,000, as the first estimate required. From Nipissing to Lake Tallon an almost straight line has been surveyed. On this part of the work there are two cuttings, one of which can serve as a lock. It was thought that to overcome the Chaudiere the canal would swing around back of Hull and join the Gatineau, but a route is obtainable whereby the re-entry to the Ottawa may be about opposite the outlet of the Rideau canal. It is believed that from Nipissing to Georgian Bay, the canal may be built for about five million dollars. A very little variation in the line or depth of water often means a saving of hundreds of thousands of dollars. The surveying work is progressing very satisfactorily indeed, and the reports as above indicated are very favorable.

What is, without doubt, the finest Canadian passenger vessel afloat is the new R. & O. steamer, Montreal, which, besides being the largest, is also the fastest of its kind. She was built by the Bertram Engine Works Co., Toronto. Her dimensions are: Length, 310 feet; width of hull, 44 feet; width over guards, 75 feet six inches; moulded depth, 15 feet. Her engines are triple expansion, of 3,000 horse-power, with stroke of 6 feet 5 inches. She has side wheels fitted with feathering curved steel buckles. Steam is supplied by six Scotch cylindrical boilers of 11 feet diameter and 12 feet length, with working pressure of 185 pounds. Her fire pumps, life-saving apparatus, etc., are of the most modern pattern. An electric light plant will furnish power for 1,200 sixteen-candle power lamps. Pumps supply running water to every stateroom. The entire steamer, including staterooms, is steam-heated. In consequence of the great width, there are three rows of staterooms on each side of the central portion of the vessel. The total number of staterooms is 250, including 200 parlor rooms, with bathrooms attached.

One of the great expenses of mining in a mountainous country is fuel for power to operate the necessary plant. The Ellwood Tinworkers' Gold Mining Co., of Lardo, B.C., near Cambourne, were fortunate enough to secure control of a mountain stream affording a constant supply at a minimum cost. In order to develop the power, Allis-Chalmers-Bullock, Limited, Montreal, who had the contract, built at their works in Montreal a compound duplex power-driven Ingersoll-Sergeant air compressor with piston inlet valves. The cylinders are 12¼ and 20¼ x 14 inches stroke, the machine traveling at 130 revolutions per minute. Mounted directly on the shaft of the compressor is a Doble water wheel, designed by the Doble Engineering Co., of San Francisco, which will develop 90 h.p. under the head of 170 feet afforded by this stream. The wheel is equipped with a patent needle nozzle fitted with hand control. The compressor will deliver 625 cubic feet of free air per minute. This system of mounting a water wheel directly on the compressor is an ideal way of generating power, as the loss by friction is very slight and all gearing, shafting, etc., is rendered unnecessary. In addition to the compressor, Allis-Chalmers-Bullock, Limited, supplied a complete outfit of drills, air receivers, columns, tripods, hose and mining sundries.

Recently the Westinghouse Electric & Manufacturing Co. have received several of the largest orders which have ever been placed for motors in industrial applications, such as the driving of machine tools, cranes, hoists and paper machinery. In four orders were included five hundred and fifty-four motors of different types and capacities, aggregating a total of 12,250 h.p. The separate orders were as follows: The Morgan Engineering Co., builders of traveling cranes and hoisting machinery, with works at Alliance, O., contracted for four hundred and thirty-five motors with a total of 10,060 h.p. The order calls for seventy-five type K motors, and the remainder are of the railway type for crane service. Their capacities vary from 2 h.p. to 100 h.p., and are all direct-current machines. The Alliance Machine Co., also of Alliance, O., placed an order for the same type of motors, although not as large. This includes ninety-one motors whose capacity aggregates 1,500 h.p. The Wellman-Seaver-Morgan Co., engineers and manufacturers, ordered thirteen direct-current motors. This firm designs and builds mining machinery and hoists, and many different types of traveling cranes. For the driving of machinery in its mills, the Rhinelander Paper Co., of Rhinelander, Wis., will install a number of alternating and direct-current motors. Eleven of these are type C induction motors, varying from 5 to 150 h.p., and the remainder are smaller type S direct-current machines. The total rated output of the installation will amount to 450 h.p.

Wayland, Williams & Dadson, manufacturers' agents, are removing from their present quarters in the Board of Trade Building, Montreal, to No. 231 St. James street, being more central. They have installed a twenty-six horsepower Campbell gas engine in the plant of the Ryall Screw & Specialty Co., of Montreal, together with a gas generator and filter.

There has been a sharp dispute recently between Americans and Canadians as to the utilization of the water power of the Rainy River. Canadians claim that they are held up by an American company, which would prevent the power being manipulated and used for Canadian interests. The matter came up at Ottawa and was held over, no decision being reached in the matter.

The Canada Machinery Agency, under the management of Mr. W. H. Nolan, Montreal, has made wonderful strides during the last few years. It is an old established concern which has built up a reputation for reliability and correctness. They represent several of the very best makers of engines and fine machinery, and it will certainly be of profit to buyers to look up this house whenever any machinery is required.

The superintendent of the Waterworks Department of Montreal has recently decided in favor of using steam-operated pumps for the water-work system there. The reason for this decision is given that using electricity will place the city system in the power of an outside corporation, and although the other would be cheaper he strongly urged the adoption of the steam units.

The enterprise of the business men of Quebec has been shown recently from the fact that an organization is on foot to secure a direct line of steamers from Quebec to Liverpool, for the exportation of which ample capital has been offered, and if the matter is carried forward in the same enthusiastic way in which it commenced the City of Quebec will no doubt see a commercial boom within the next year.

The first sod for the Western Construction Works on the new transcontinental highway will be turned in the neighborhood of Kakabeka Station on the branch that is intended to give the G.T.P. connection with the great lakes at Fort William. The location plan has been approved by the Railway Commission, and gives the company authority to set about the building of between three and four miles east and west of Kakabeka.

Creelman Bros., of Georgetown, manufacturers of knitting accessories, are enlarging their building and adding new machinery to enable them to handle their growing trade. At present they are working on some very substantial orders from France, Belgium and Mexico. In addition to their regular output they have added several new styles to their manufacture, necessitating an addition to their staff as well as a new power unit.

During the present season at least 100,000 tons of Bethlehem Yale and New Era ore will be shipped from Ashland, Wisconsin, to the Algoma Steel Co., at the Canadian Soo. Considerable ore will also go to the Canada Furnace Co. at Midland. This port has never before shipped over one-third this amount to Canadian ports, the business starting in 1902, with a half dozen cargoes. The quality of ore being sent to the Canadian furnaces is of the very best grade Bessemer, valued at $4 per ton. The Canadian ships Iroquois, Monkshaven, Leafield, Strathcona, Paliki and Barlum are now engaged in the trade.

Some time ago, Professor Haanel, Superintendent of Mines, Ottawa, with others, went to Europe to investigate iron smelting by electricity, and a valuable report has been printed dealing with their observations. Professor Haanel has also induced the Dominion Government to set apart a sum of $15,000 to make a practical test in Ontario. Mr. Clergue has offered the department a building and free, power for electricity for four months, and as they have a splendid outfit of machine shops and skilled labor, all available at reasonable cost, it has been decided to experiment at the "Soo," where ore from various localities can be assembled cheaply and quickly. Dr. Harault, of France, who has had extensive experience in Europe in smelting iron by electricity, is to be in charge and make the test. Experiments will also be made in treating the nickel ores of Sudbury locality, as there are quantities of the nickel mattes at the "Soo." The plant will not be in operation for a couple of months, as the furnace is not fully designed yet, and the electroids have to be imported from Sweden, nothing of the kind being available here. In a country as scarce of fuel as Ontario is, and dotted with water-powers, where cheap electricty can be produced, there seems to be a great opening for electric smelting. We have an enormous quantity of iron deposits in Ontario of different values. In the past some of these were classed as having too much sulphur, some too much phosphorus, or perhaps some other objectionable materials, while, again, some deposits are so situated that fuel costs too much to bring to the ore. With electric smelting a success and power transmission so favorable, almost every deposit in Ontario of a reasonable value can be worked.

New Machine Shop.

Walker Bros., Orillia, are putting up a new machine shop and foundry in the rear of their former premises on West street, and have the same well towards completion. The buildings are of modern time, with concrete foundations and walls. A cupola has been installed and this firm will be in the market for more machinery equipment at a later date. They have undertaken the manufacture of gasoline engines of their own design, and do general repair work.

Large Plant For Montreal.

The J. C. White Co., of New York, who are amongst the largest electrical builders and contractors in that city, have recently organized a Canadian company, with a capital of $1,000,000, and propose erecting a large new plant in Montreal. The company includes several Canadian capitalists. It is intended to do business throughout the entire Dominion and their only manufacturing plant will be in Montreal. The name of the company will be the Canada White Co., Limited, and besides manufacturing will carry on a general contracting and engineering business.

Visit of American Engineers.

Mr. A. E. Vaughan, representing the American Institute of Mining Engineers, was in Montreal recently arranging the final details of a trip which the members of that body will make over the line of the C.P.R. from Vancouver to Portland during the month of July. He was in consultation with Passenger Traffic Manager Kerr on the subject. The trip over the C.P.R. will follow one from New York to Seattle over American lines, and will be undertaken upon the return of the members from Dawson, where they will have examined the mining industries in the Yukon and Alaska. A day and a night will be spent at Banff.

Canadian Enterprise in United States.

A Canadian firm, the Robb Engineering Co., of Amherst, N.S., who have been for the past forty years manufacturing a high-grade line of engines and boilers, are about to extend their scope still further. The president of the company, Mr. D. W. Robb, recently organized the Robb-Mumford Co. for the purpose of manufacturing a special line of water-tube boilers. The demand for these boilers in the United States during the past two years has been so great that the company was warranted in establishing a new plant at Framingham, Mass. Mr. D. W. Robb, of Amherst, and Mr. G. W. Cole will be the president and secretary-treasurer respectively of the Robb-Mumford Co., with Mr. F. H. Keyes, of Newtonville, as general manager.

Extensive Power Mills Company.

A big company has recently been organized, comprising the A. Kelly Milling Co., of Brandon, and the Lake Huron & Manitoba Milling Co., of Goderich, to do an extensive milling business in Western Canada. The new organization will erect a 4,000 barrel mill near Winnipeg and a half million bushel storage elevator and a warehouse capable of holding 60,000 barrels of flour, together with a complete line of new elevators throughout Manitoba, including twenty-six already in operation. This will give them full capacity of 2½ million bushels, and they will be able to turn out 6,500 barrels of flour and 200 barrels of oatmeal daily. The directors are: A. Kelly, Brandon; S. A. McGaw, Goderich; W. J. Lindsay, Brandon; Jos. Wright, Arthur Hills, Lukes and Mitchell, all of Toronto. Mr. Kelly was elected president, Mr. McGaw vice-president and general manager, Mr. E. J. Barclay, Brandon, treasurer, and Mr. Hills, secretary.

New Industry at Hamilton.

During the present year a new industry has been introduced into Canada with the advent of the Canadian Drawn Steel Co., Limited, who are now busily erecting an extensive mill at Hamilton, Ont. This company has secured three

acres of land in the industrial annex of that city, where they are bounded on the north by the G.T. Railway, and on the east by the T.H. & B. Railway, thus providing exceptional shipping facilities. The main building, which is now almost completed, is a substantial brick structure sixty feet by two hundred and sixty, a feature being that the trusses are the full span and all shafting placed under the floor, thus giving a perfectly clear floor space. The power used will be entirely electric, and wherever possible the drives will be by independent motors, so that there will be very little shafting required.

Adjoining the main building is a boiler house, oil house and store, the former containing a high pressure boiler to supply steam for heating purposes in the Winter, and for use in part of the process of preparing the rough bars for drawing.

It is intended at an early date, on the completion of this company's factory, to give a detailed account of the works, with illustrations, which should be of great interest to readers of Machinery.

The Union Drawn Steel Co., Limited, an American firm now manufacturing in Pennsylvania, have also acquired premises in Hamilton for the manufacture of cold drawn steel bars and shapes, this making two distinct firm to start an industry new to Canada almost simultaneously.

Canadian Patents Granted to Foreigners.

Below will be found a list of Canadian patents recently granted to foreigners through the agency of Messrs. Marion & Marion, patent attorneys, Montreal, Canada, and Washington, D.C.

Information regarding any of these will be cheerfully supplied by applying to the above-named firm:

93,021—Julius Welter, Malaga, Spain: Mechanical multiplication tables.

93,118—Christian Esser, Vienna, Austria: Apparatus for the treatment of peat fibre for the manufacture of halfstuff.

93,138—Dr. Louis Mary, Fegershelm (Alsace-Lorraine), Germany: Pottery molding machine.

93,153—Prof. Edoardo Maragliano, Genoa, Italy: Manufacture of meat powder.

93,208—Henri Iscovesco, Paris, France: Process for treating butter.

93,298—Heinrich Beck, Meiningen, Germany: railway sleepers.

93,298—Heinrich Beck, Meinigon, Germany: Electric arc lights.

Laurie Engine Co.

Owing to difficulties in reorganization and certain legal matters, the Laurie Engine Co., of Montreal, entered into voluntary liquidation on May 29th.

The works on St. Catherine street east will continue in operation and an early and satisfactory settlement is expected by the provisional liquidator, Mr. J. M. Mackie.

The company, which is one of the oldest and most widely known of Canadian enterprises, has been in process of reorganization, and two months ago a new charter was granted. Previously the company had been operating under latters patent from the Provincial Legislature, but under the limited powers of this charter the directors were not in a position to carry out their plans.

A scheme was laid before the shareholders offering them one share in the new company for three in the old one, but this was not accepted generally, and meanwhile the combination of circumstances compelled the company to go into liquidation.

The assets of the company are good and the liability to the trade amounts to about $40,000. The largest creditors are the directors, who have been financing the company.

Lack of sufficient capital was the cause of the difficulty. It is expected that an amicable arrangement can now be reached, and it is thought that a good dividend can be paid. Then it will be possible to sell at a good figure to the new company, and on this basis of reorganization the Laurie Engine Co., Limited, will continue in operation.

In answer to an inquiry by a representative of Canadian Machinery, Mr. J. M. Mackie stated that everything was progressing favorably. Owing to it being routine work, it will necessarily be some time before everything is satisfactorily settled. Mr. Mackie also stated that the company had plenty of work on hand, and if the present circumstances could be arranged, the future would no doubt be all that could be desired.

Companies Incorporated.

Frothingham & Workman, Limited, Montreal, have reduced their share capital from $550,000 to $453,000.

Breitong Iron Co., of Michigan, has been granted power to develop mining property in Ontario with U. McFadden, of Sault Ste. Marie, as attorney.

Duplex Hanger Co., of Ohio, has been granted power to manufacture hardware and building material in Ontario, with J. H. McGregor, Toronto, as attorney.

The Canadian Rubber Co., of Montreal, Limited, have been granted additional powers under the Canadian act under which they are incorporated. The share capital is now $ 300,000.

Fort William Dredging and Harbor Improving Co., Fort William; share capital, $150,000; purpose, to improve harbors. The directors are: E. R. Weyland, L. L. Peltier, and T. E. Dean, all of Fort William.

Guelph Windmill and Mfg. Co., Guelph, share capital, $50,000; purpose, to manufacture windmills and implements. The directors are: G. A. Black and F. X. Frank, of Guelph, and F. C. Cockerton, of Plattsville.

Canadian Fire Protecting Co., Toronto; share capital, $100,000; purpose to manufacture fire-proofing material, etc. The directors are: H. F. White, A. D. Crooks, G. W. Marsh and J. A. C. McCuaig, all of Toronto.

Duncan Electrical Co., Limited, Montreal; share capital, $90,000; purpose, to manufacture electrical supplies. The directors are: C. Duncan, W. P. Bear, W. King, F. Loomis, and M. L. Williams, all of Montreal.

Selkirk Gas and Oil Co., Selkirk, Ont.; share capital, $10,000; purpose, to develop oil property. The directors are: R. J. Winyard, J. W. Holmes, W. H. Smelser, N. Overholt, D. Jepson and A. Aldrich, all of Selkirk.

Blackford Oil & Gas Co., Limited, Windsor, share capital, 30,000; purpose, to develop oil property. The directors are: F. B. Preston, W. F. McCorkle, W. A. Spitzley, J. H. Brogan, and E. D. Preston, all of Detroit.

Selby & Youlden, Limited, Kingston, share capital $50,000; purpose, to manufacture boilers, engines, machinery, etc. The directors are: C. Selby, H. Youlden, S. J. Dainty, M. F. Thompson, and A. Orr, all of Kingston.

Gutteridge-Sullivan Co., Limited, Sarnia; share capital, $40,000; purpose to manufacture brick machinery, etc. The directors are: T. P. Bradley, S. A. Armstrong, T. J. Gordon, J. R. Pierdon and J. Sullivan, all of Sarnia.

J. W. Harris Co., Limited, Montreal; share capital $150,000; purpose, to do a general contracting business. The directors are: J. W. Harris W. B. Powell, F. D. Munk F. Z. Durand and P. G. Martineau, all of Montreal.

Franco-American Automobile Co., Limited, Montreal; share capital, $20,000; purpose, to manufacture motor vehicles. The directors are: T. Craig, S. Page, H. B. Rainville, L. M. Patenaud and G. Husson, all of Montreal.

Canadian Ladder Co., Limited, Toronto; share capital, $40,000; purpose, to manufacture ladders, fire escapes, etc. The directors are: R. Robinson, J. M. Turner, J. J. Ward, W. W. Stoddard and W. R. Pearce, all of Toronto.

General Specialty Co., Montreal; share capital, $20,000; purpose to manufacture patented articles. The directors are: J. M. Warmington, J. S. Smith, P. F. Richardson, H. J. Elliott, of Montreal, and J. M. Reid, Outremont, Que.

Paul Automatic Gas Co., Limited, Montreal; share capital $145,000; purpose, to manufacture gasoline machines. The directors are: F. Paul, jr., F. Paul, sr., E. Chapdelaine, O. Dupois, of Sorel, Que.; and G. Leclare, of Montreal.

Ajax Metal Co., of Canada, Montreal; share capital $50,000; purpose, to manufacture metals and alloys. The directors are: G. M. Pyke, J. R. Meadowcroft, W. D. Hutchings, W. J. Henderson and W. D. Garland, all of Montreal.

Standard Explorers, Limited, Montreal, share capital $300,000; purpose, to manufacture explosives and chemicals. The directors are: W. T. Rodden, J. F. Johnson, W. J. White, A. W. P. Buchannan and E. H. Barker, all of Montreal.

Carter White Lead Co. of Canada, Montreal; share capital $475,000; pur-

pose, to manufacture lead products. The directors are: E. J. Cornish, Omaha; P. M. Carter, J. F. Oshmera, C. F. Morrow, and J. W. Nield, all of Montreal.

Explosives Co., of Canada, Montreal; share capital, $500,000; purpose, to manufacture powder and ammunition. The directors are E. B. Pritchard, E. H. Smith, E. N. Cote, W. J. Lewis, of Montreal, and J. M. Lynch, of Lachine, Que.

Selkirk Electric Light & Power Co., Limited, Selkirk, Man.; share capital, $50,000; purpose, to manufacture power for lighting and heating. The directors are: R. M. Stuart, H. Pollard, J. Y. Haig, of Winnipeg, and J. Stalker, of Selkirk.

Canadian White Co., Limited, Montreal; share capital, $1,000,000; purpose, to manufacture electrical machinery and do construction work. The directors are: W. G. Ross, R. C. Smith, R. C. Grant, W. W. Skinner and W. F. Shipman, all of Montreal.

Calumet and Algoma Mining Co., Sault Ste. Marie, share capital, $1,000,000; purpose to develop mining properties in Ontario. The directors are: J. Hermann, J. Vertin, C. Schenk, H. E. Lean, L. Ceasar, H. Bibber and F. Roehm, all of Calumet, Mich.

Portland Mica Co., Limited, Ottawa; chare capital $6,000; purpose, to develop mineral property. The directors are: F. W. Webster, Boston, Mass.; J. F. Higginson, Buckingham, Que.; H. Aylen, Ottawa; O. R. Taylor and T. W. Symmes, both of Aylmer, Que.

Maple Leaf Automobile & Electrical Mfg. Co., Limited, London, share capital $50,000; purpose, to manufacture automobiles and electrical appliances. The directors are: J. O. Weldon, G. H. Rapson, D. Fergusin, H. S. Albertson, and W. Barton, all of London.

Pease Heating Co., Limited, Toronto, share capital $40,000; purpose, to manufacture and install heating and plumbing apparatus. The directors are: D. Millar, A. M. Bond, J. M. Bell, D. W Stark, R. B. McKinnon, J. L. Ross, and F. W. Johnson, all of Toronto.

Canadian Fence Mfg. Co., Limited, Woodstock, share capital $250,000; purpose, to manufacture and sell wire fences, etc. The directors are C. A. Brink, N. Stickney, and G. Bragg, of West Oxford; J. B. Murray, of West Zorra, and T. H. Blachford, of East Oxford.

Canadian Shovel & Tool Co., Limited, Hamilton, share capital $150,000; purpose, to manufacture shovels and other tools. The directors are J. C. McCarty, G. B. McCarty, of New York; C. H. Holton, of Easton, Pa.; F. Skelton, of Wainsburg, Pa., and W. A. Holton, of Hamilton.

The Fidelity Oil and Gas Co. Limited, Leamington, Ont.; share capital, $100,000; purpose, to develop oil property. The directors are. J. W. Rosendale, J. W. McKay, J. Layden, T. H. Rochford, all of Buffalo, and A. S. Holmes, of Leamington, Ont., and W. J. Coffee, of Bradford, Pa.

Jas. Stuart Electric Co., Limited, Winnipeg; share capital, $100,000; purpose to acquire the business of the E. S. Harrison Co., Limited, and deal in electrical power and supplies. The directors are: J. Stuart, R. M. Stuart, J. T. Haig, F. W. Louthood and I. Dillon, all of Winnipeg.

New Liskeard and Northern Ontario Mining and Developing Co., Limited, New Liskeard, share capital $25,000, purpose, to mine and mill minerals. The directors are: J. Cox, J. H. O'Brien, J. O. Margueratt, J. C. Moss, F. W. Haynes, H. Thompson, and E. Monahan, all of New Liskeard.

Union Screen Plate Co., of Canada, Limited, Lennoxville, Que.; share capital $20,000; purpose, to manufacture machinery and carry on a general iron and brass foundry business. The directors are: E. Crocker, Fitchburg, Mass.; H. W. S. Downs, G. Henry, F. Gadette, all of Lennoxville, Que.; and H. D. Lawrence, of Sherbrooke, Que.

Gurney Oxford Stove & Furnace Co., Limited, Toronto, share capital $40,000; purpose, to manufacture and deal in metals, and carry on the business now carried on by the Gurney Oxford Stove & Furnace Co., Toronto. The directors are E. Gurney, W. C. Gurney, E. H. Gurney, W. H. Carrick, and F. F. Skinner, all of Toronto.

AN IMPROVEMENT FOR BOILERS.

At a time when locomotive engineers have almost reached the limit in heating surface in the boilers of railway engines, owing to the fact that bridges prescribe the height, and that considerations of evaporative efficiency discourage longer boilers, some results of the use of the Serve ribbed tube on French lines are of interest. These tubes are well known by marine engineers. Owing to the internal ribs they give off much more heat than ordinary tubes. M. Sauvage, the chief locomotive authority in France, has made a long series of practical tests, and finds that one ribbed tube is equivalent in evaporative efficiency to $2\frac{1}{4}$ smooth tubes. The heating surface per lineal foot is 1.18 square foot for the ribbed tube and 0.92 square foot for the smooth tube. The heating surface is increased nearly 30 per cent. by the use of the ribs, and the efficiency increases at an even greater ratio. The cost has operated against more extensive use in this country. The present price of Serve tubes in France is two and a half times that of smooth tubes, but the cost per lb. of water evaporated does not appear to differ much.

CONTENTS.

MACHINERY BUYERS' DIRECTORY.

Readers of Canadian Machinery are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principal firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

Abrasive Materials.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Air Brakes.
Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Air Receivers.
Chicago Pneumatic Tool Co., Chicago.

Arc Lamps.
Canadian General Electric Co., Toronto.
The United Electric Co., Toronto.

Augers.
Chicago Pneumatic Tool Co., Chicago.

Babbit Metal.
Canada Metal Co., Toronto.

Barrels, Tumbling.
The Globe Machine, and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.
Niles-Bement-Pond Co., New York.

Batteries, Storage.
Chicago Pneumatic Tool Co , Chicago.

Bell Ringers.
Chicago Pneumatic Tool Co., Chicago.

Belting, Leather.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.
Williams & Wilson, Montreal.

Belting Cotton.
Dominion Belting Co., Hamilton.
Sadler & Haworth, Montreal.

Belting Supplies.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.
Niles-Bement-Pond Co., New York.
Chicago Pneumatic Tool Co., Chicago.

Blowers.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Boilers.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Boiler Compounds.
Canada Chemical Mfg. Co., London, Ont.

Bolt Cutters.
National Machinery Co., Tiffin, Ohio.

Bolt and Nut Machinery.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

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Technical Pub. Co., Manchester.
The MacLean Pub. Co., Ltd., Toronto.

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B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Niles-Bement-Pond Co.. New York.

Boring Machines, Wood.
Chicago Pneumatic Tool Co., Chicago.

Boring and Turning Mills.
American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Bulldozers.
National Machinery Co., Tiffin, Ohio.

Cabinets, Tool.
Armstrong Bros. Tool Co., Chicago.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
Rice Lewis & Son, Toronto.

Castings, Grey Iron.
F. L. Hare, Oshawa, Ont.

Castings, Brass.
F. L. Hare, Oshawa, Ont.

Calipers.
L. S. Starrett & Co., Athol, Mass.
Rice Lewis & Son, Toronto.
Williams & Wilson, Montreal.

Centering Machines.
Pratt & Whitney Co., Hartford, Conn.

Centres, Planer.
Pratt & Whitney Co., Hartford, Conn.

Chucks, Ring Grinding.
Chicago Pneumatic Tool Co., Chicago.

Chucks, Drill and Lathe.
Ker & Goodwin, Brantford.
King & Crosby, Hamilton.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Chucks, Planer.
Francis Reed Co., Worcester, Mass.

Chucking Machines.
American Tool Works Co., Cincinnati.
Niles-Bennett-Pond Co., New York.
H. W. Petrie, Toronto.
Potter & Johnston Mach. Co., Pawtucket, R.I.

Circuit Breakers.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Compressors, Air.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Consulting Engineers.
Charles Brandeis, Montreal.
John S. Fielding, Toronto.
Roderick J. Parke, Toronto.
T. Pringle & Son, Montreal.

Controllers and Starters, Electric Motor.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock Co., Montreal.

Cotton Belting.
Sadler & Haworth, Montreal.

Cupola Blowers.
Sheldon & Sheldon, Galt, Ont.

Cutters, Flue.
Chicago Pneumatic Tool Co., Chicago.

Cutters, Milling.
Becker, Brainard Milling Machine Co., Hyde Park, Mass.
Pratt & Whitney Co , Hartford, Conn.

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H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

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H. W. Petrie, Toronto.
Mechanics' Supply Co., Quebec.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

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Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.
W. H. Banfield & Sons, Toronto.
The Globe Machine and Stamping Co., Cleveland, Ohio.

Dies, Threading.
W. H. Banfield & Sons, Toronto.
Pratt & Whitney Co., Hartford, Conn.

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Mechanics' Supply Co., Quebec.

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King & Crosby, Hamilton.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.
Francis Reed Co., Worcester, Mass.

Drills, Blacksmith.
Francis Reed Co., Worcester, Mass.

Drills, Centre.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.
L. S. Starrett Co., Athol, mass.

Drills, Clamp.
Francis Reed Co., Worcester, Mass.

Drills, Electric.
Chicago Pneumatic Tool Co., Chicago.

Drills, High Speed.
Wm. Abbott, Montreal.
Pratt & Whitney Co., Hartford, Conn.

Drills, Horizontal.
B. F. Barnes Co., Rockford, Ill.

Drills, Pneumatic.
Chicago Pneumatic Tool Co., Chicago.

Drills, Ratchet.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.

Drills, Rock.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.
Francis Reed Co., Worcester, Mass.

Drills, Twist.
Chicago Pneumatic Tool Co , Chicago.

Drilling Machines, Boiler.
American Tool Works Co., Cincinnati.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Multiple Spindle.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Bickford Drill & Tool Co., Cincinnati.
Canada Machinery Agency, Montreal.
Niles-Bement-Pond Co., New York.
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Williams & Wilson, Montreal.

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Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drilling Machines, Radial.
American Tool Works Co., Cincinnati.
Bickford Tool & Drill Co., Cincinnati.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Upright.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
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Sheldon & Sheldon, Galt, Ont.
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Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London, Ont.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
United Electric Co., Toronto.
Volta Electric Repair works, Toronto.

Electrical Supplies.
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Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London, Ont.
Packard Electric Co., St. Catharines.
The United Electric Co., Toronto.
Volta Electric Repair Works, Toronto.

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Allis-Chalmers-Bullock, Montreal.
American Tool Works Co., Cincinnati.
Canada Machinery Agency, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

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Volta Electric Repair Works, Toronto.

Emery Wheel Dressers.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.

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Mechanics' Supply Co., Quebec.
Rice Lewis & Son, Toronto.

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H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

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The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

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Sheldon & Sheldon, Galt, Ont.

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Fans, Electric.
Canadian General Electric Co., Toronto
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The Smart-Turner Mach. Co., Hamilton.
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Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

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H. W. Petrie, Toronto.
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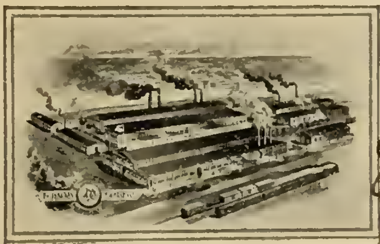

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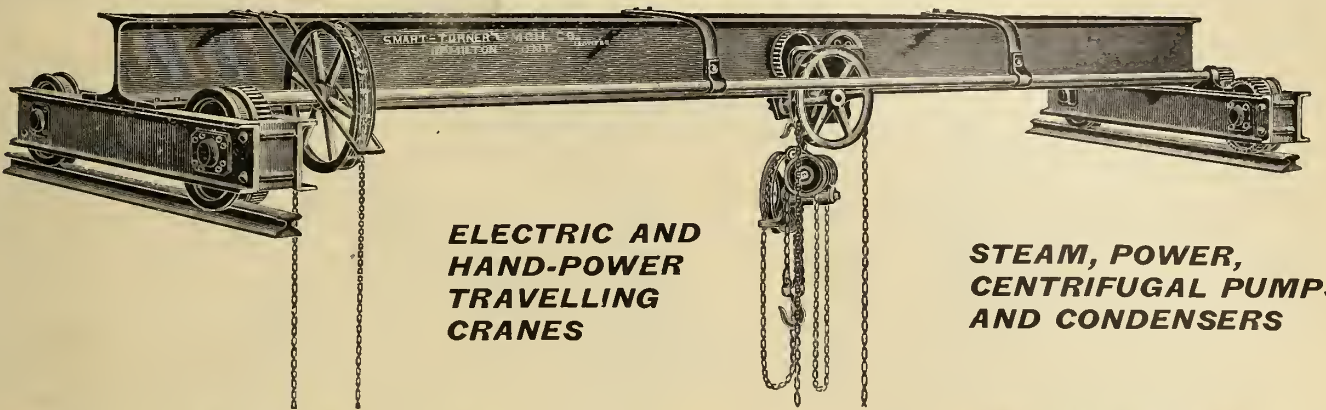

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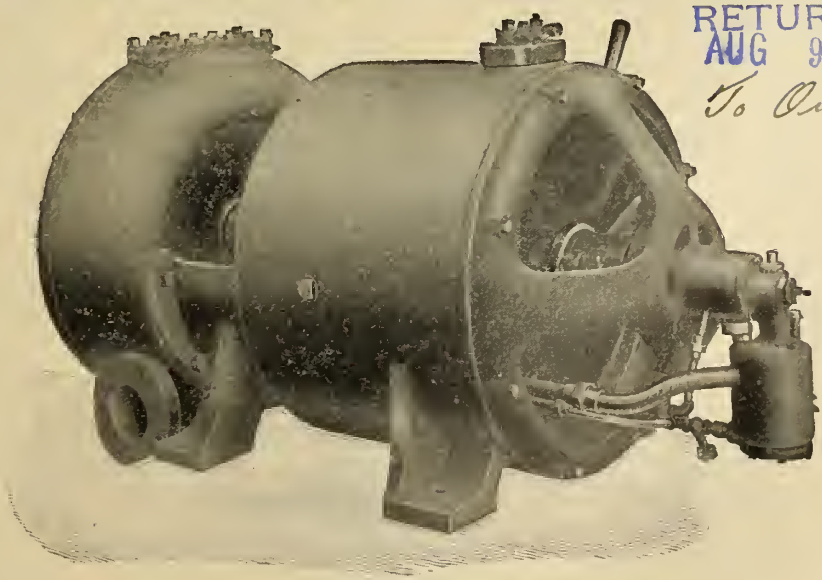

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The United Electric Co., Toront

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Chicago Pneumatic Tool Co., Chicago.

Hose, Couplings.
Chicago Pneumatic Tool Co., Chicago.

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Rolla L. Crain Co., Ltd., Ottawa.

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Sheldon & Sheldon Galt.

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Machinery Exchange, Montreal.
Mechanics' Supply Co., Quebec.
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The Smart-Turner Mach. Co., Hamilton.
Williams & Wilson Montreal.
C. C. Wormer Mach. Co., Windsor.

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Mechanics' Supply Co., Quebec.
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Sheldon & Sheldon, Galt.
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Pratt & Whitney Hartford, Conn.

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Niles-Bement-Pond Co., New York.
Pratt & Whitney, Hartford, Conn.

Milling Machines, Plain.
American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Canada Machinery Agency, Montreal.
Cincinnati Milling Machine Co., Cincinnati
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Milling Machines, Universal.
American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Canada Machinery Agency, Montreal.
Cincinnati Milling Machine Co., Cincinnati
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Milling Machines, Vertical.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Niles-Bement-Pond Co., New York.

Milling Tools.
Wm. Abbott, Montreal.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.

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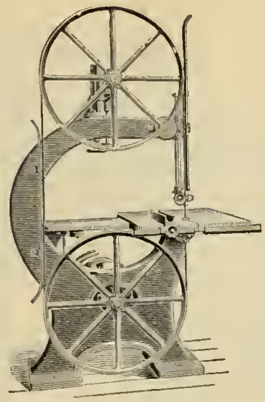

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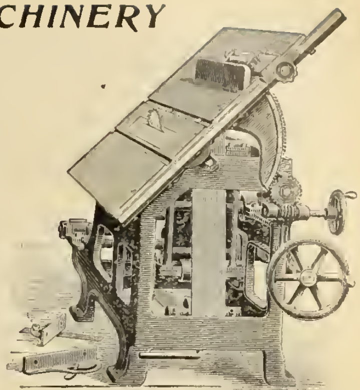

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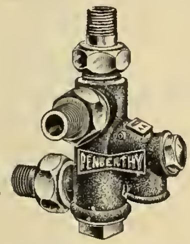

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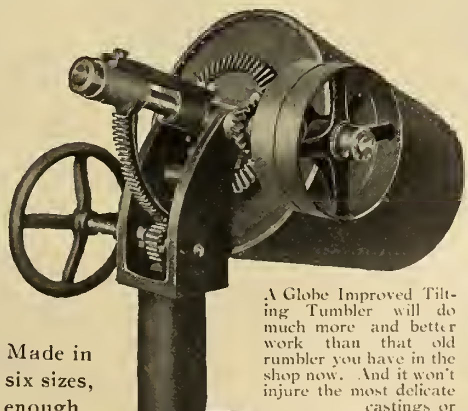

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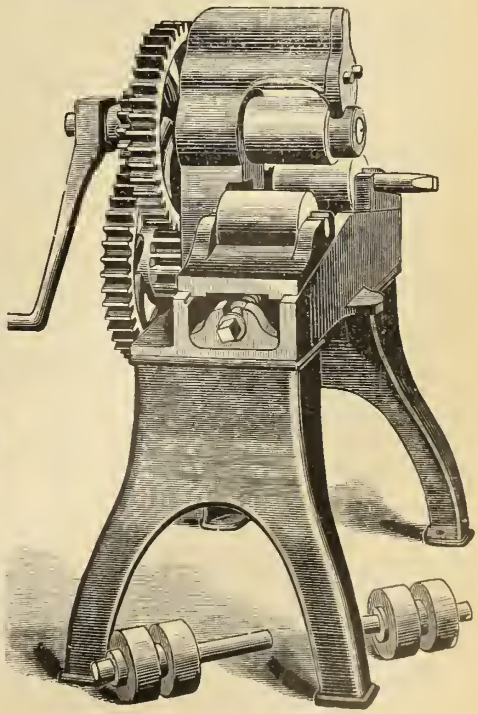

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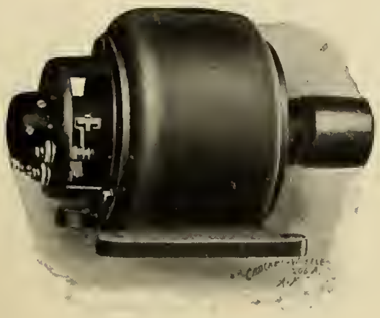

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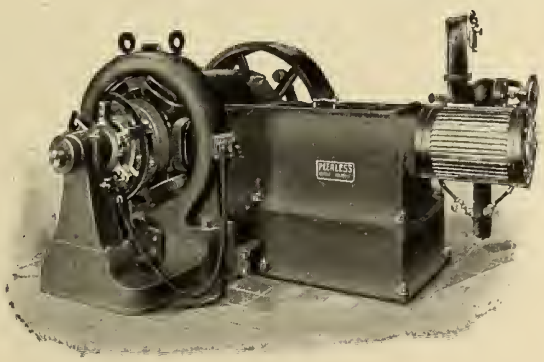

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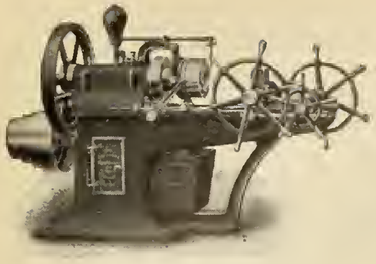

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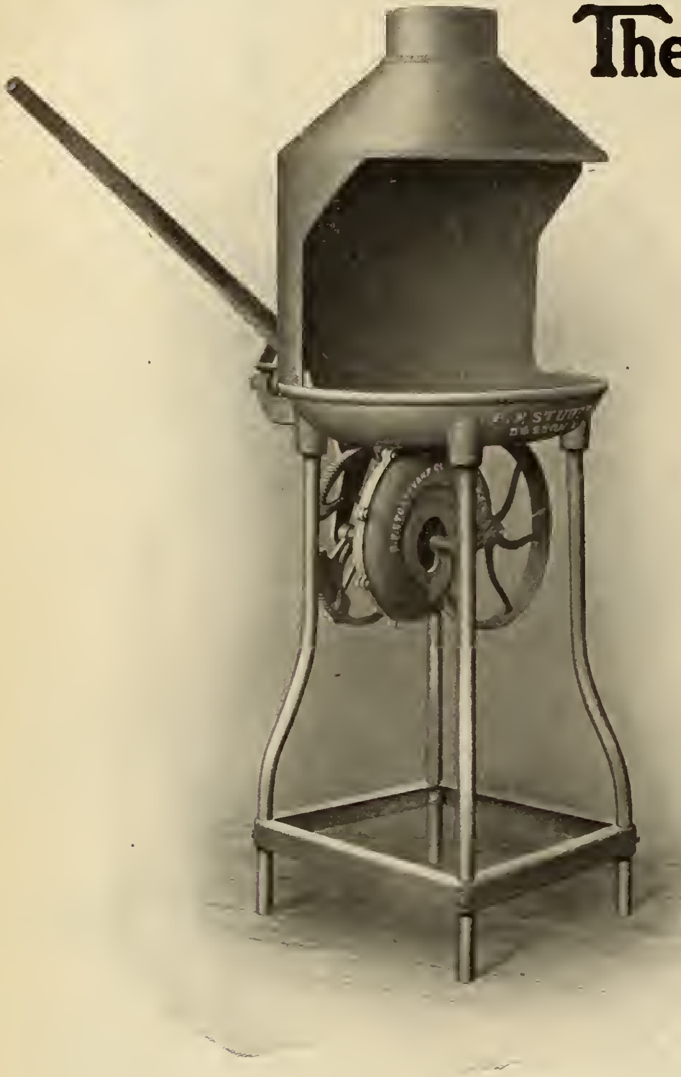

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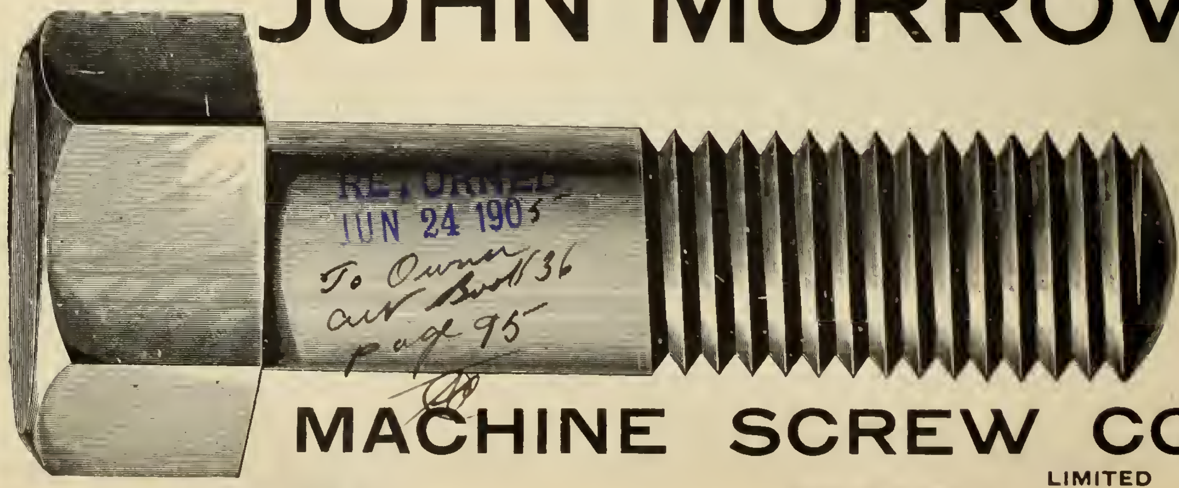

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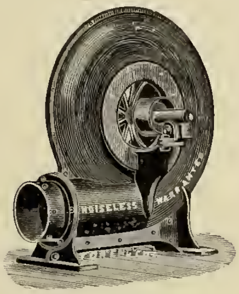

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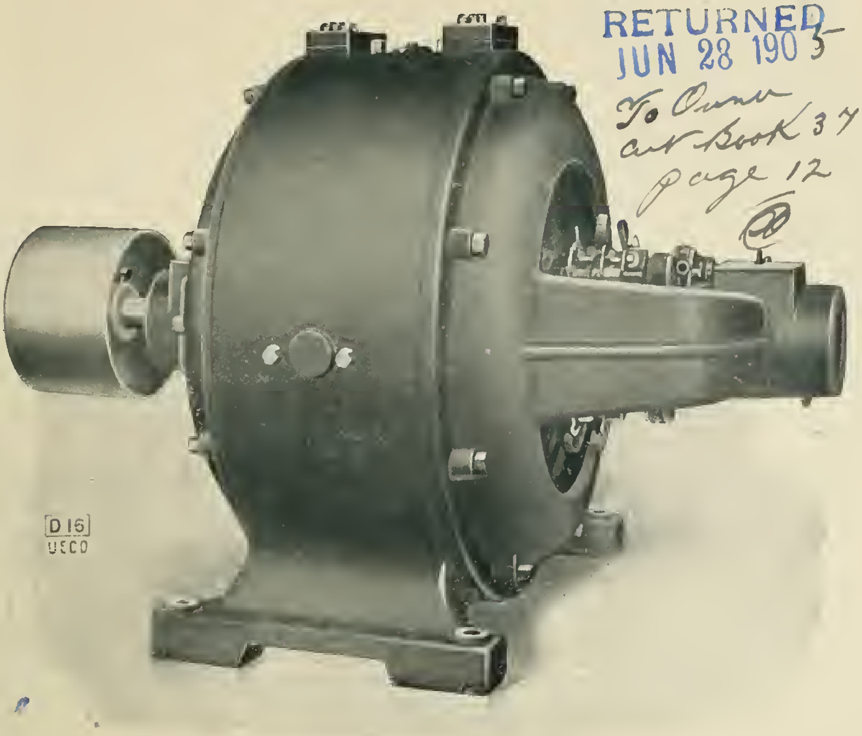
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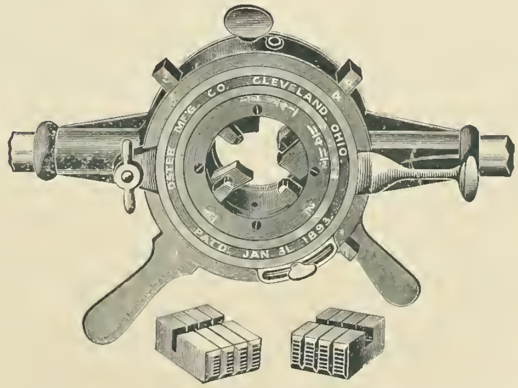
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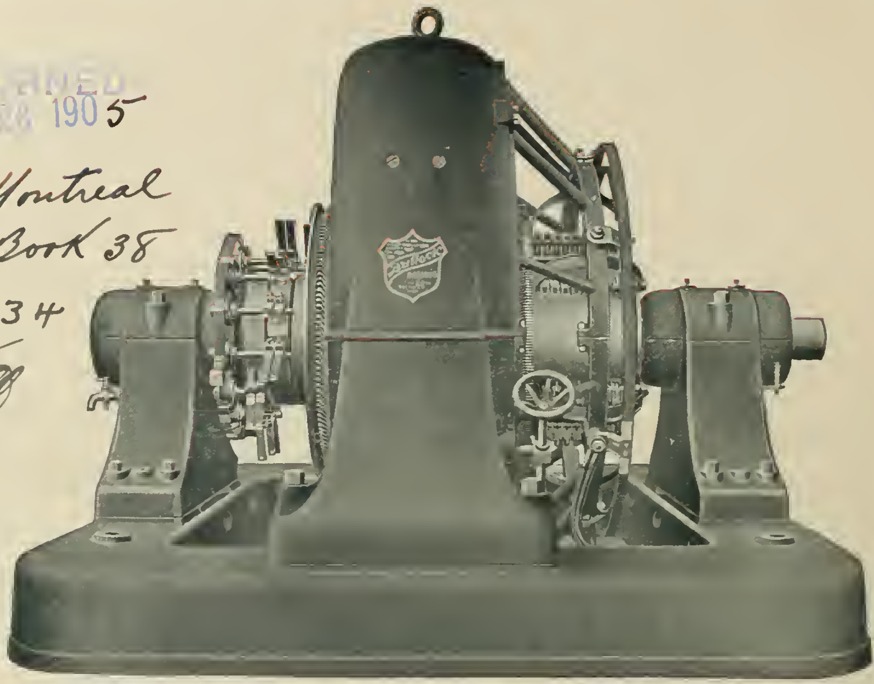

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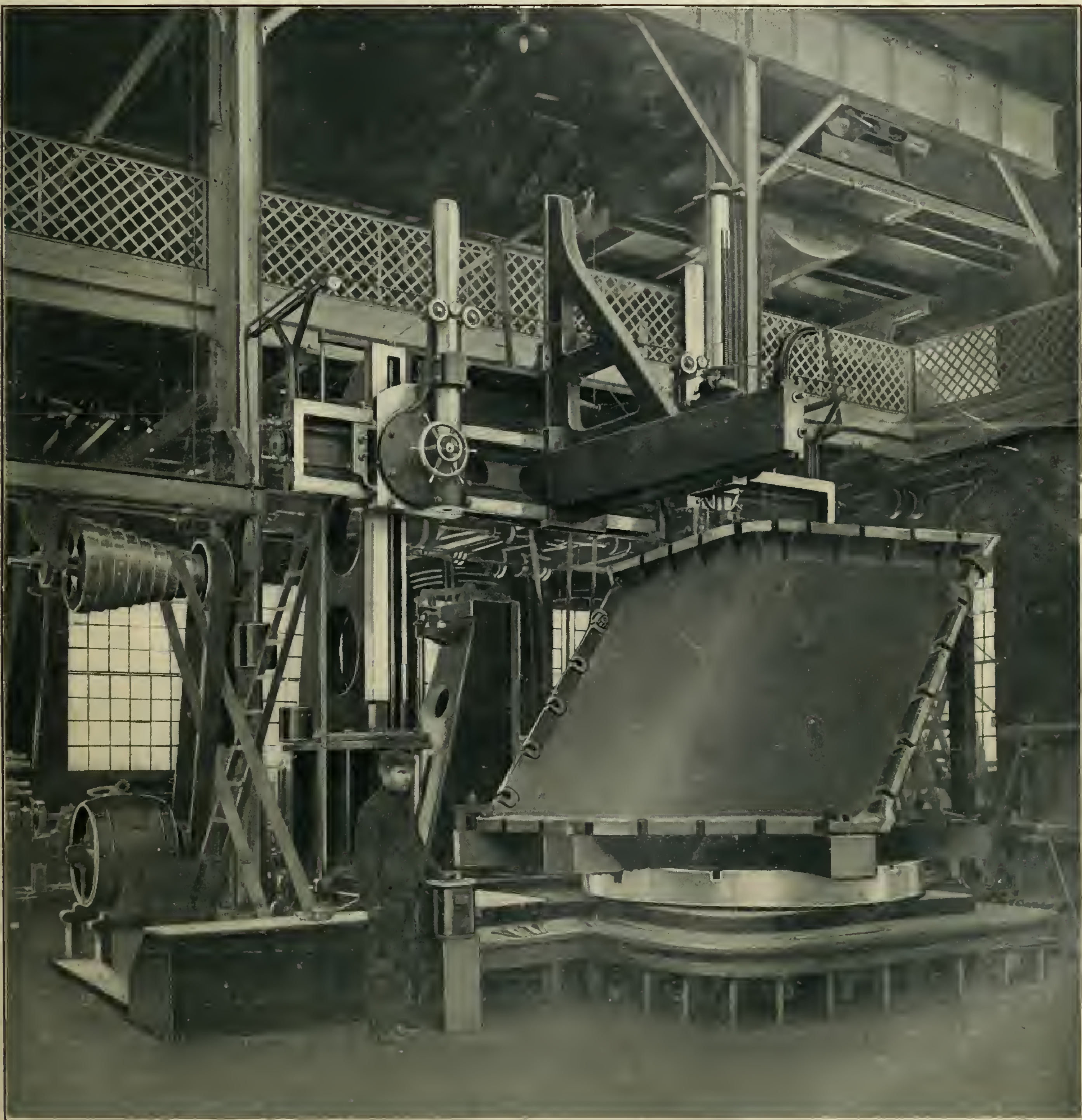

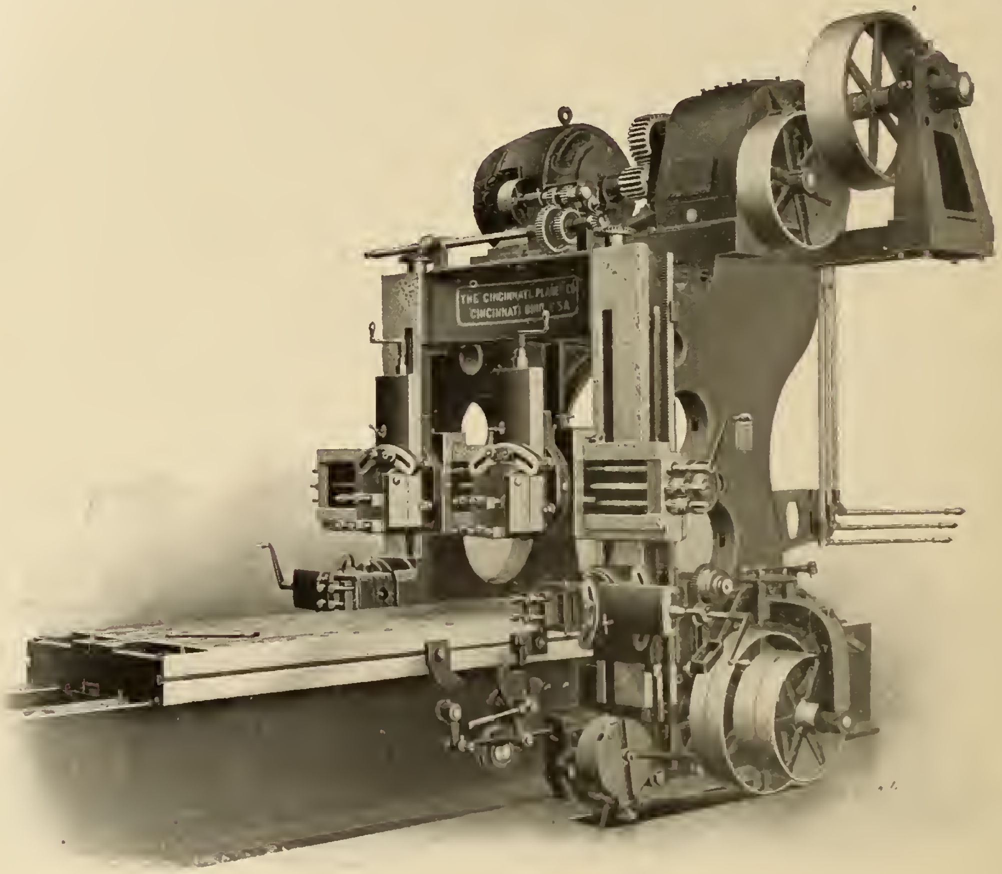

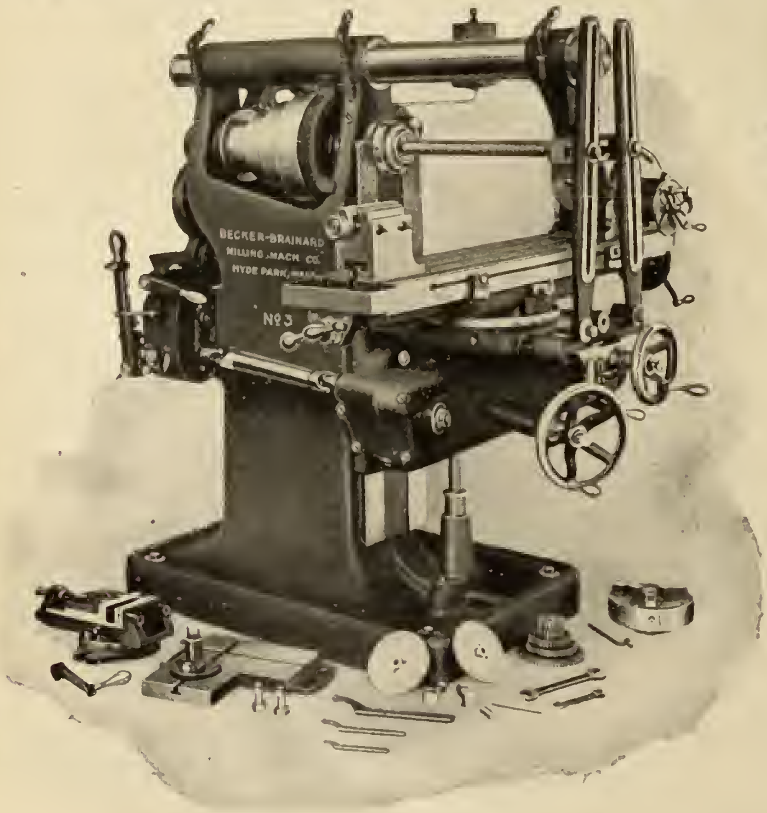

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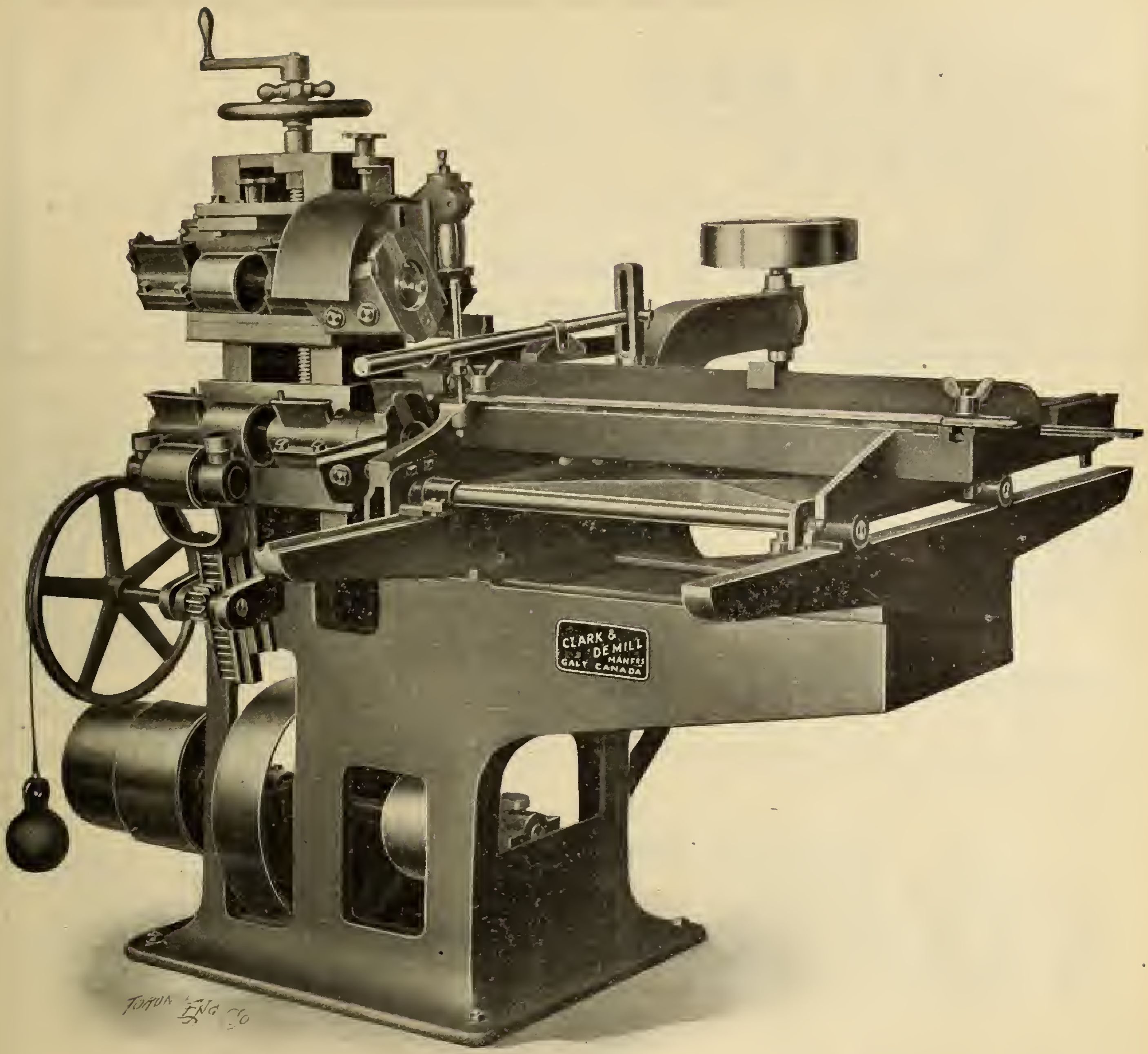
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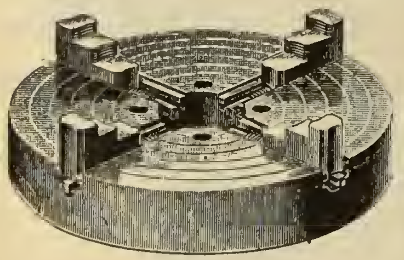

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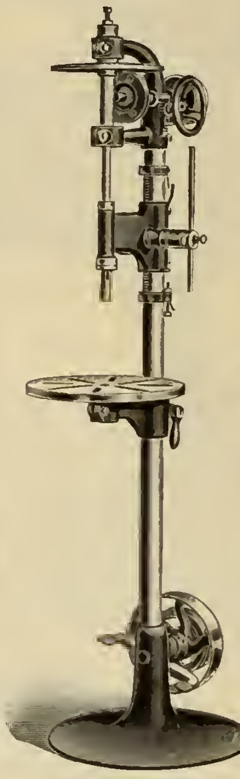

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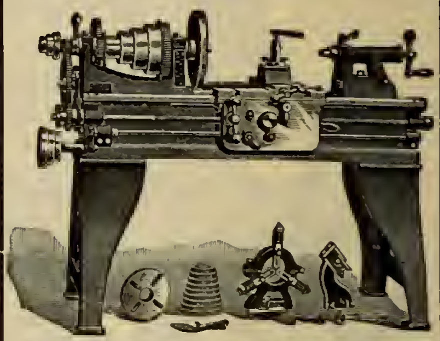

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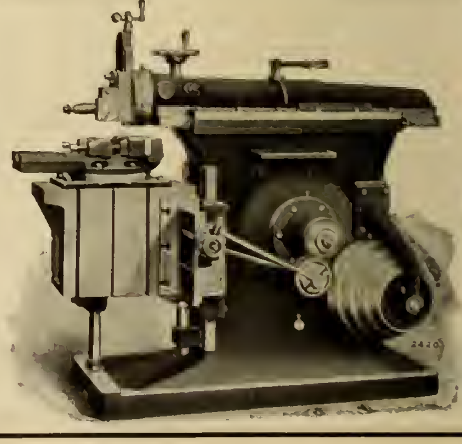

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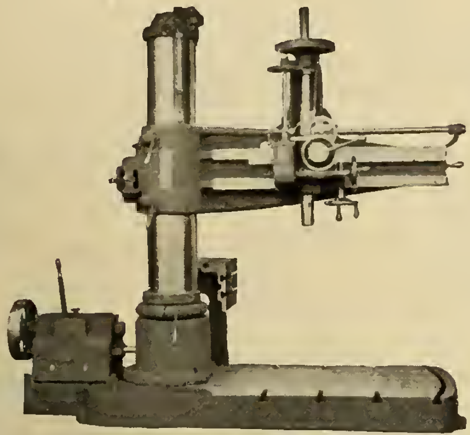

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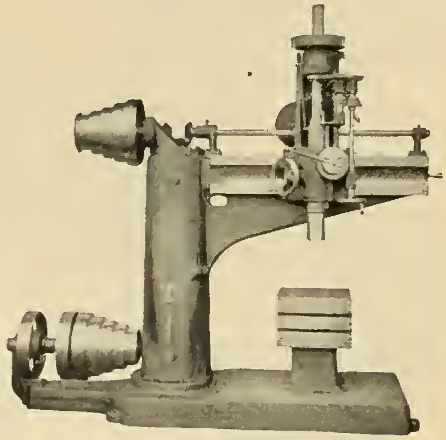

SEMI RADIAL

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Cincinnati, Ohio, U. S. A.

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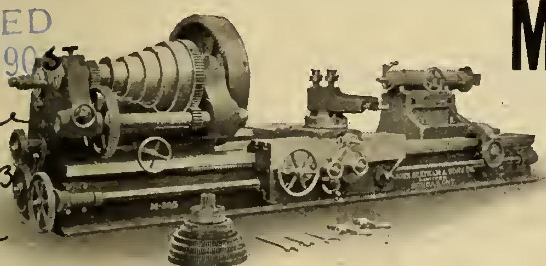
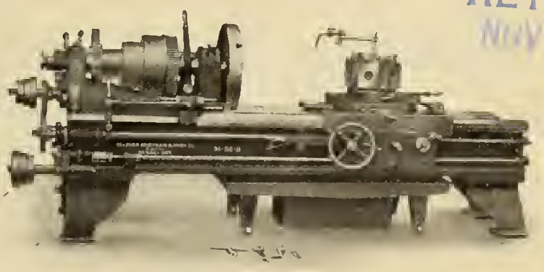
MACHINE TOOLS



Bertram's 60 in. Engine Lathe



Bertram's 24 in. Lathe with Turret on Saddle and Friction Head

We equip any of our machine tools with motor drive.

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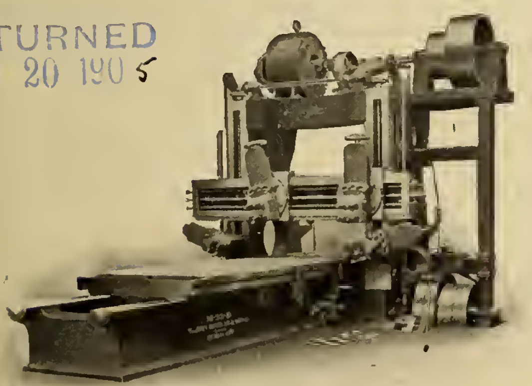
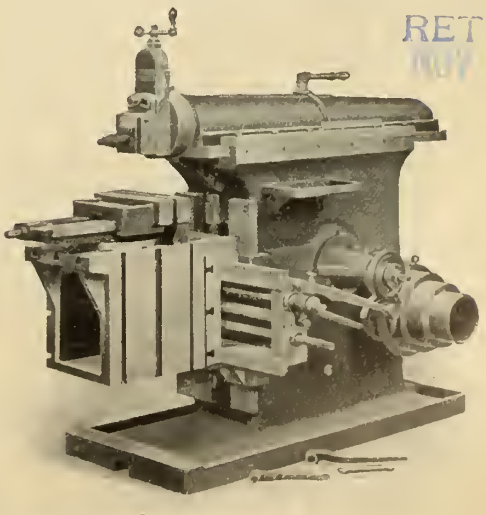
Ask for descriptive circular of any machine.



Bertram's 48 in. x 48 in. Iron Planer



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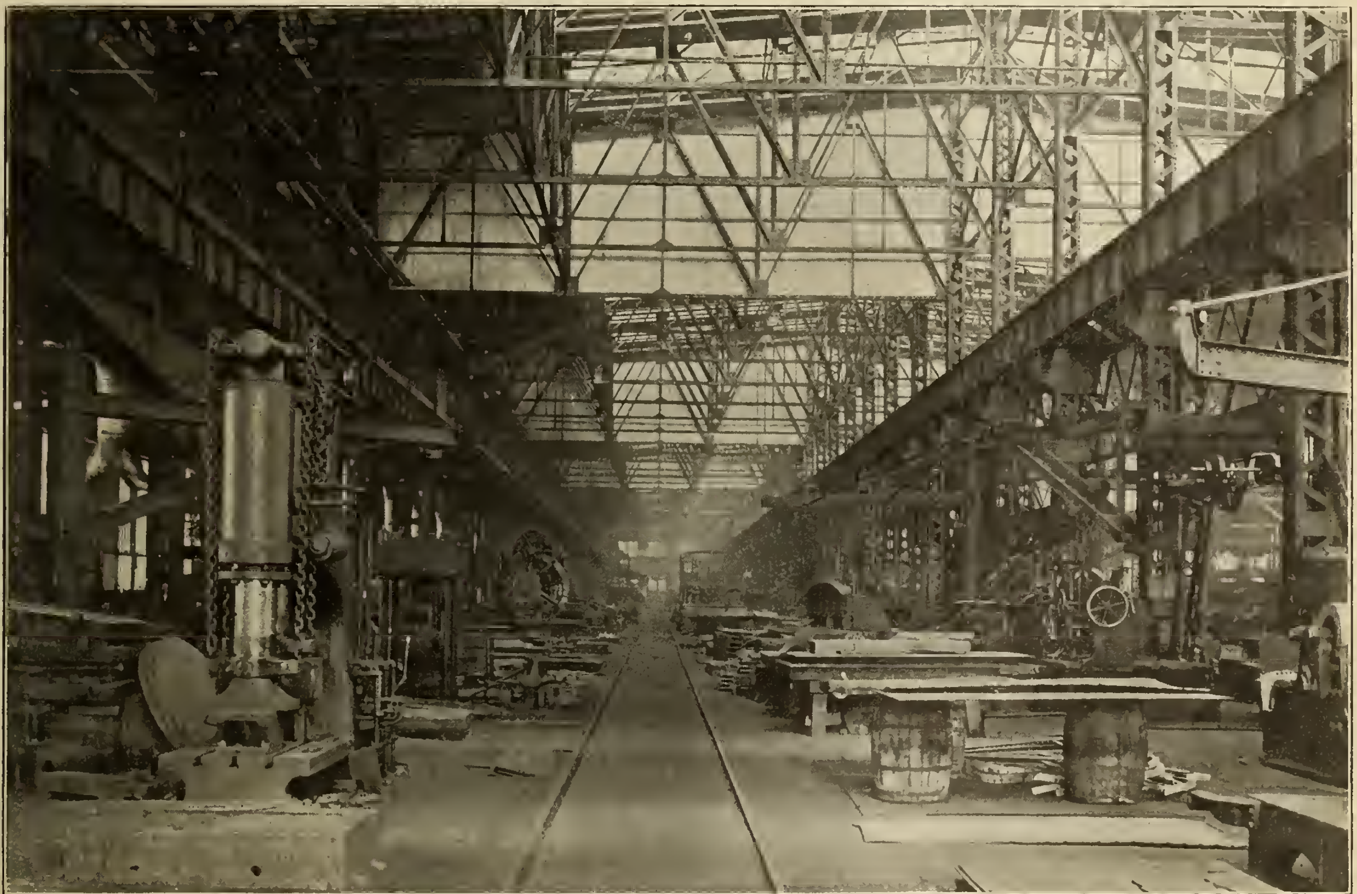
Modern Canadian Manufacturing Plants

ARTICLE VI.—Machine Shops—Canadian Pacific Railway—Angus Shops—Montreal.

OF necessity, building a locomotive demands a large amount of heavy machine work, where the parts to be machined weigh not only pounds, but, in many cases, tons. The degree of accuracy required is, however, just as imperative throughout as on smaller work. These two features combined demand in the machine shops of a locomotive works the fulfilment of special requirements, based on the conditions to be met. Probably the first impression the visitor receives on entering the machine shops of the Canadian Pacific Railway at Montreal is that of the enormous scale upon which operations are carried out and the ease with which the heavy work is handled. The other feature, that of precision, he notices later, or has pointed out to him by some of the officials of the mechanical department, to whose courtesy Canadian Machinery is indebted for the information in this article.

The car machine shop takes care of all the work for the erecting shop, the output of which is 30 cars a day. The work done here is of a much lighter nature than that of the locomotive machine shop. In a previous article was given a plan showing the location of the different shops and buildings and their relation to each other in the general scheme, together with their construction, so that it will be needless to dwell further on these points.



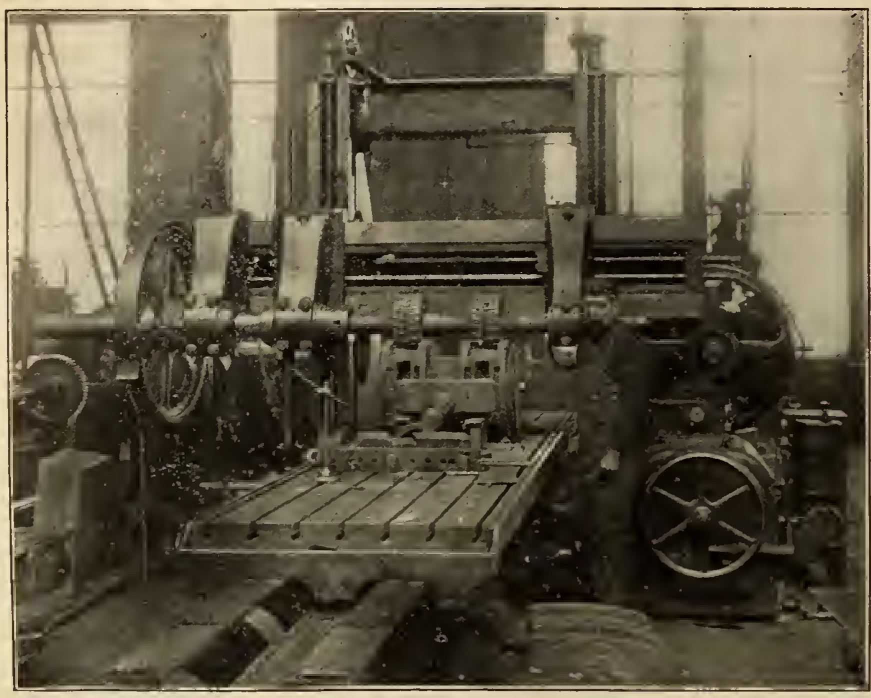
Machine Bay of Locomotive Shop—Angus Shops.

Erecting and Maintenance.

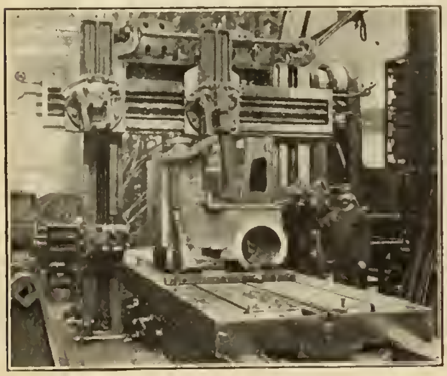
Across the midway from the blacksmith shop, arranged for minimum transportation of material, is the machine shop where work for erecting and road maintenance for the entire line is machined. Here, besides the installation of a machine shop equipment, with its accompanying tool room to take care of large output, is placed a complete nickel-plating and oxidizing plant, including plating, buffing and dipping rooms and a brass department. In the plating plant the metal parts for finishing the passenger and sleeping car interiors are taken care of. The plating and oxidizing are done in separate rooms. The dipping room contains vats of hot and cold water, sawdust, acids, solutions, etc., where all material is washed before and after being plated. The plated articles when polished and washed are lacquered and sent to the drying oven. The brass department looks after all brass works, machining and finishing the hundred and one brass fittings used in modern railway coaches.

One of the features of this shop is the set of 6-spindle Bertram drilling machines with a capacity to drill simul-

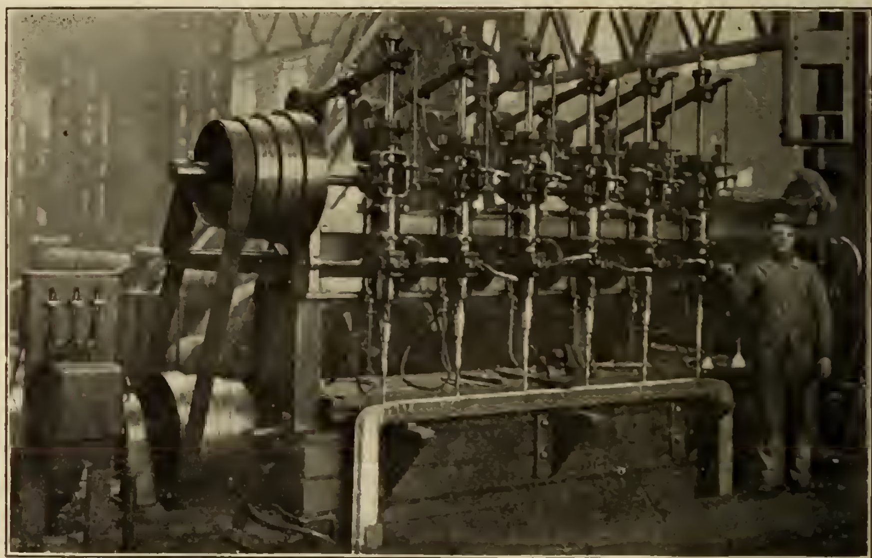
taneously six $1\frac{1}{4}$-inch holes in steel. The distance between the housings is 6 ft. 6 in., and the spindles have a vertical travel of 12 inches and are counterweighted, while three changes of power feed are provided, also hand adjustment by rack and pinion. In drilling bars on these machines the bars are placed in a jig instead of being marked, and centre themselves. There are as well three arch bar drills, each capable of turning out from 70 to 75 arch bars a day, and 13 pin drills for all small work from 1-16 to 9-16. Four Bertram wheel lathes turn out four pair of 40-inch wheels a day, and one Pond lathe of heavier build turns out six pairs. Another feature of this shop is the threading machinery. Eleven threading machines, doing work from $\frac{3}{8}$ to 2 inches, thread all the bolts for the new freight and passenger cars and for repairs all along the line. All the bolts are conveyed in iron boxes from the blacksmiths' shop. A great saving is effected in this way, as the work is handled from box to box, the bolts never touching the floor, thus doing away with any chance of their being mixed. All nuts and turn buckles are tapped in this shop by five 1-inch and three $1\frac{1}{2}$-inch nut tappers. There are in all over 90 tools in operation, run in individual and group drives by motors aggregating 265 h.p.



Milling Grooves in Driving Boxes, 48-in. Niles-Bement-Pond Horizontal Milling Machine.



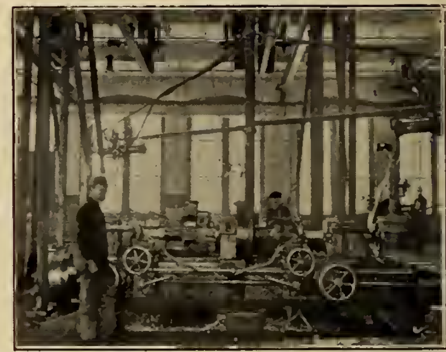
Planing Valve Seat and Front Frame Bearing.



Drilling Mud Rings, Niles-Bement-Pond, 6-Spindle Drill.

Largest in America.

Peculiar interest is attached to the locomotive building, of which the machine shop shown in the illustration takes up a large part. It is 1,167 feet long by 162 feet 8 inches wide, and is divided into three bays, one 80 feet wide for the erecting, the machine shop bay 55 feet wide, and on the west, one 25 feet, having a gallery running the entire length of the building. The floor area is 190,384 square feet. The length of the part devoted to the machine shop is 770 feet with a total area, including gallery, of 62,575 square feet. There are 245 machines in operation, with a total floor area of 255 square feet per machine.

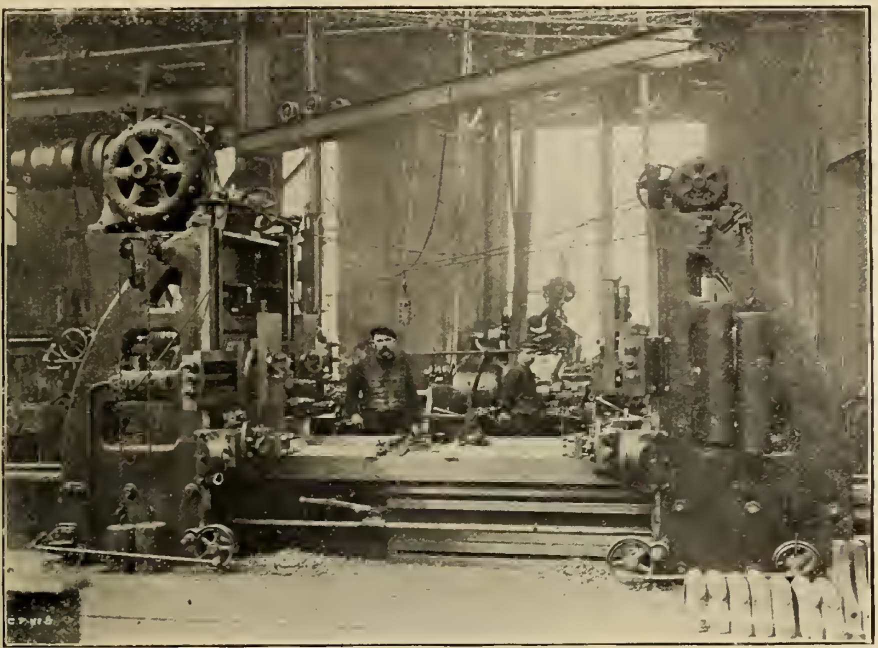


Turning Both Ends of Car Axle at same time.

Handling and Transportation.

The proper routing and handling work was a problem that came in for a good deal of consideration, as in a plant of this size it is an even greater factor in the cost of production than in a smaller plant. A double track industrial railway connects the machine shop with the blacksmith shop, and standard gauge tracks, seven in all, run from end to end of the building. In the matter of cranes it is well equipped. There is a 60-ton crane in the erecting shop, a 20-ton crane for the boiler shop, and one of 15 tons for the machine shop, besides a 5-ton traveling crane for the truck shop. In addition to these, there are

two 5-ton jib cranes, one electric and the other pneumatic, three 2-ton cranes with pneumatic cylinders, and a 4-ton of the same size, three 1,000-pound pneumatic cylinder bracket cranes, and one of 1,500 pounds capacity.



Planing Four Guide Rods at same time on 48-in. Niles-Bement-Pond Double Planer.

Electric Drives.

All the tools in the shops are driven electrically, either individually or in groups according to the scheme in operation throughout the entire plant. Eight machines, namely, a locomotive crane drill, a 90-inch mill with three motors, a 60-inch boring mill, one milling machine, a cylinder borer, double-head shaper, and two smaller boring mills, are driven by direct current, variable speed drive. Three machines have inindividual motors, the cylinder planer, a three-head slotter and the 90-inch wheel lathe, while all the others are operated in groups, driven by Canadian General Electric induction motors installed overhead.

Turning Steel Tired Car Wheels.

Contract System Adopted.

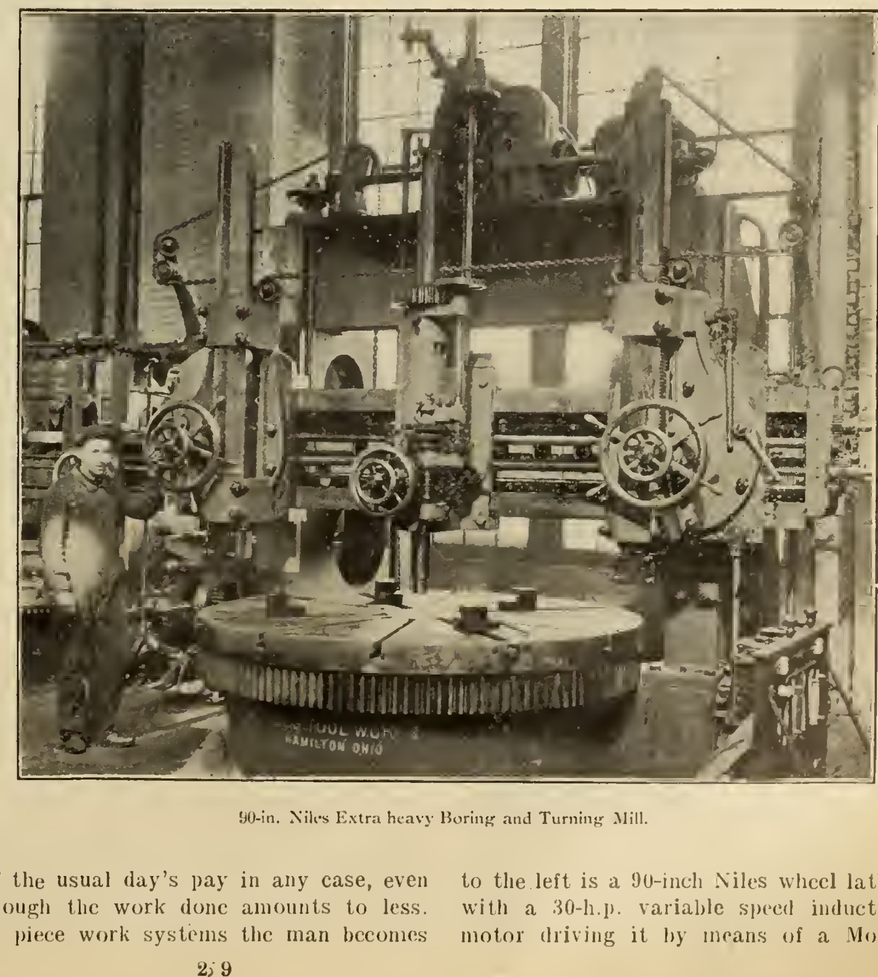
The contract system of paying for services rendered by the workmen has been in operation in the Angus shops for some time and has been found very satisfactory. It meets with favor among the men and serves as a bond of union between the employer and the employe. The men make from 20 to 40 per cent. above day wages as a rule, when working by contract. It carries a guarantee of the usual day's pay in any case, even though the work done amounts to less. In piece work systems the man becomes a mere automaton, but here he is lifted to a higher plane and becomes a partner in the concern. Although this complicates the making up the pay roll and makes more work in figuring the slips for the 1,300 men at work in the building, the management, after a fair trial, have decided that it is superior to any other, both from the viewpoint of work done and the relationship existing between the men and their foremen.

Minimum Output Sought.

Among other economics aimed at is that of getting a maximum output from the machines in operation. This is attained by the expeditious handling of all material with cranes, electric and pneumatic, trucks, hydraulic jacks, the use of high-speed steels in all cases and a highly perfected system of jigs and templets, as well as the latest in pneumatic tools. There is an air of lively industry in evidence here, more so than is usually found in large manufacturing establishments. Blue chips from the machines are abundant, showing at least that the machines are not running slow speed for the work they are turning out.

Machines and Machining.

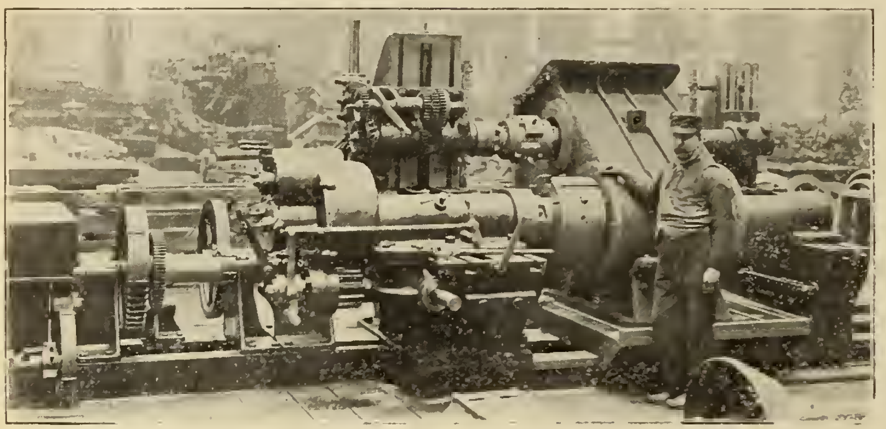
The work done is best shown by taking up the work of some of the machines installed and in operation. On entering the north door the first large machine to the left is a 90-inch Niles wheel lathe, with a 30-h.p. variable speed induction motor driving it by means of a Morse



90-in. Niles Extra heavy Boring and Turning Mill.

chain. It is a heavy machine weighing about 50 tons, strong and with large journals. A cutting speed of 12 feet per minute is used, the machine being designed for taking cuts one-half inch deep, 3-16 inch feed.

A Niles-Bemet-Pond three-spindle cylinder boring machine is of special design. It bores simultaneously the cylinder and its piston valve chamber, boring practically all cylinders for all the engines turned out for the C.P.R. Another special machine is a connecting-rod boring machine built by John Bertram & Sons for boring the ends of locomotive connecting rods, in which special attention has been given to quickness and ease of operation. It has a capacity for connecting rods 132 inches long and for holes up to 10 inches in diameter.



Boring Cylinder and Piston Valve Chamber, Niles-Bement-Pond, Three-Spindle Cylinder Boring Machine.

To handle the locomotive frames requires very special machinery, and the drill used for these is worthy of attention. The frames to be machined consist of a solid forging 28 feet long and weigh 3,600 lbs. The drill used is a Niles-Bement-Pond 4-spindle frame drill. The spindles have cross-adjustment to and from the cross-rail, and the heads can be moved along the cross-rail so that holes may be drilled in any position, while one of the heads swivels for drilling holes at an angle. An unusually large turret lathe, the first of its kind built, is also in operation here.

Among others supplied by John Bertram & Sons are: A 20-inch slotting machine with a maximum stroke of 21 inches with a cutting bar adjustment for any length and position of stroke up to the capacity of the machine; a horizontal boring and drilling machine, the main table of which is 8 feet long and is supported on two large screws, raised and lowered by power; 48 in. by 48 in. iron planing machine, which planes stock 49 inches wide and 49 inches high, and an hydraulic wheel press motor, driven with Morse silent chain connection.

The use of horizontal slab milling machines is an innovation in railway shops for doing driving-box work. The driving boxes are faced off on the horizontal milling machine, a number being put on the table at one time. The grooves for shoes and wedges are milled out and the shoes and wedges themselves machined in the same machine. Some other of the machines installed and operating at the Angus shops are shown in the illustrations. Unfortunately some of the photographs of the special machines made by John Bertram & Sons, Limited arrived too late to have half-tones made, but readers of Canadian Machinery may have a chance to see some of them in these pages in another issue.

It is impossible within the scope of this article to enumerate the many specially made high-class machine tools in operation at these shops. Enough has been said to give the reader some idea of the work turned out. These shops are an index to the spirit of the times where manufacturers find it economy, although at increased initial expenditure, to install not only the best tools, but the most efficient labor-saving devices known.

Tool Closets in Machine Shops.

By J. C. Armer.

IN railway machine shops there is usually a night gang working, for various reasons, whether large or small depending upon the amount of work at the shops. Usually the night gang is not greater than half the strength of the day gang, and consequently at night there are many tools idle which are running during the day time. Very often members of the night gang take advantage of this fact to gather together tools of precision, and cutting tools that they have need of, or that they think they may have need of in the future. It is very irritating for a machinist to come back in the morning and find that some one of the night gang has "buried," as they say in the shops, his best pair of calipers, or some of his cutting tools; or, perhaps, find that one of the tools he has carefully ground the night before has been used during the night for something it was not intended for, and that there are so many nicks in it and its shape has been altered so that half-an-hour's grinding is required on it before it can be used.

Of course such things are impossible where there is a tool closet with lock and key for each machine. However, there are shops where tool closets are too few, and often unsuitable for the requirements. Very often for want of a better place the planer bed or the lathe bed is made a receptacle for tools, where they are mixed up with cuttings, and the one needed at the time is always the hardest to find.

Some one comes along to a planer hand and wishes to borrow a certain tool. The machine man knows he has such a tool on the bed of his planer, but because of the peculiarity of the set-up of his job he cannot move his reversing dogs, and, therefore, cannot run the table from above his tools. Instead he gets down under the planer, and after groping for a while with his hands and getting his eyes full of dust, he finally emerges with the required tool.

This is the actual state of things in more than one large machine shop, and one would think that the attention of the management would be called to it. The putting in of suitable tool closets would not require a very enormous outlay, and the resulting convenience to the machinists would certainly make the installing of them worth the expense. Besides the convenience for the machinist is not the only factor for consideration. The management will probably be gainers in time and tool material. The machinists will lose no time because of "buried" tools, or because of having to re-grind a tool that some other person has "put on the rocks." Nor will there be so much extra work for the tool-forger to do.

Neatness is also a factor, and having suitable closets distributed around the shop would suggest neatness to the machinist, and possibly the machines would not be so littered with templates, tools, bolts, dogs, straps, etc., as they otherwise would be.

Modern Milling Practice

By John Edgar.

Field of the Milling Machine.

THE milling machine as it stands to-day is one of the most useful machine tools we find in the manufacturing establishment. Since it embodies all the good points of its parents—the lathe and planer—it has displaced them in a great many operations and is a strong competitor in many more.

No other machine tool has had to withstand so much criticism, which in its early days was very disastrous to its progress. But the fight that its promoters had to put up was the means of non-ceasing effort on their part to produce a machine that would allow of but few faults being found. Therefore we see it in its present stage, one of the most improved machine tools on the market.

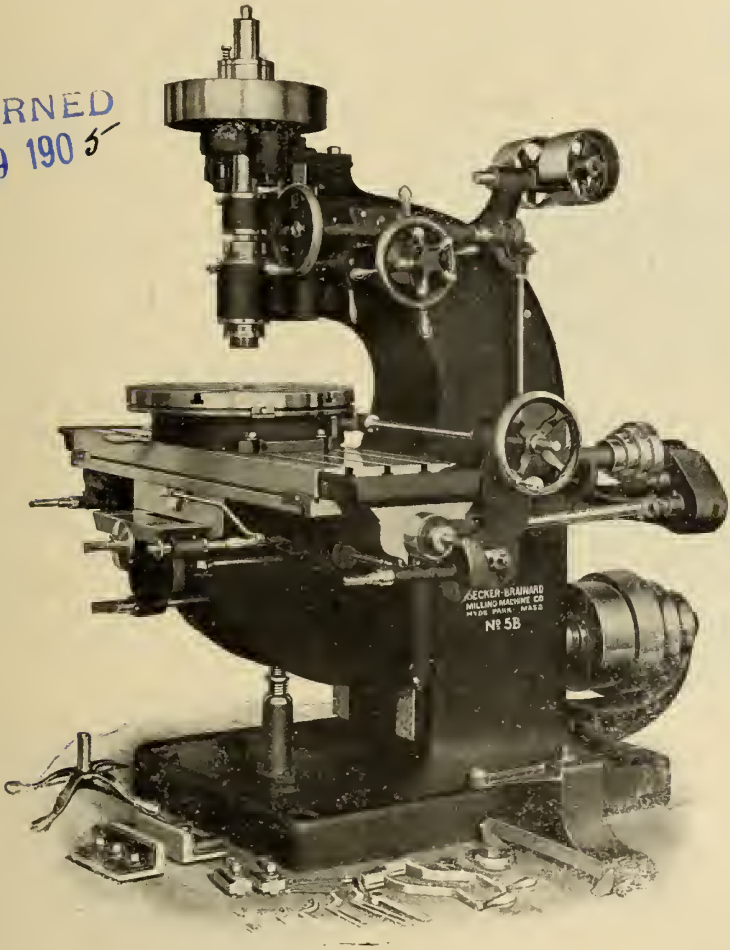


Fig. 1.

The milling machine has reached its majority. It has begun to demonstrate its usefulness. It being an active factor in reducing the cost of production, has entered to a great extent in the progress that has been made in the machinery world within the last few years. We may find on every side testimonials to its merit. Would it have been possible for the typewriter to have reached the high state of perfection in which we now find it had we no milling machines? Is it not the milling machine that has made possible the fine repeating arms with which modern armies are equipped? In fact what machine can be found that has done so much for the world at large.

No great progress has been made where antiquated methods are still in use. The milling machines, not unlike other machines in this respect, must be run with due regard to its efficiency and rated output, that is, we must have a machine and equipment best suited to the work to be done in order to obtain results that are at all satisfactory.

Conditions Necesary.

In order to meet this requirement we have three important conditions to fulfill :

I. We must have a machine of a size and style chosen in view of the work it is to do.

II. Our machine must be fitted with suitable fixtures for receiving the work.

III. The cutters must be so proportioned that we may get the best results with the least expenditure of time in sharpening, and with the minimum amount of power.

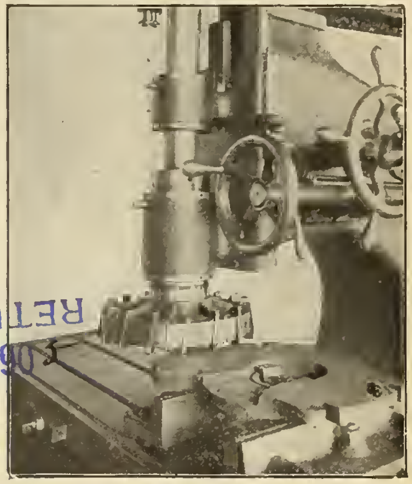


Fig. 2.

In fulfilling condition 1 the purchaser must fully understand the requirements of the class of work the machine is expected to do. He must remember that very few machines are capable of handling any great range of work with success, that is, a large machine will not be satisfactory on small work, and vice versa, nor will a medium-size machine handle large work successfully. In selecting a machine of any kind the purchaser, especially if he is not a practical shop man, is liable to sacrifice efficiency in his effort to reduce the monetary outlay to the minimum. He must not be disappointed in the results if he does so, and this will be most apparent in the case of the milling machine. There is no machine in which poor workmanship and lack of properly

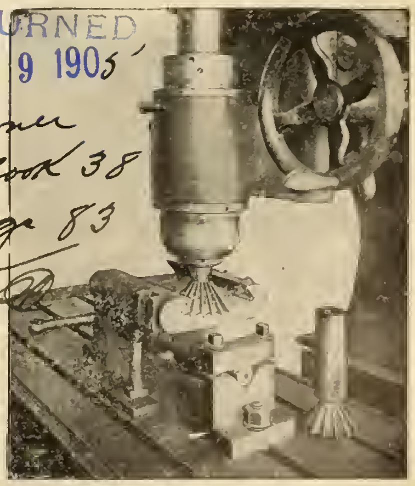


Fig. 3.

distributed weight show to such a disadvantage as in this type of machine tool, and there is nothing that will exaggerate these difficulties as will a mill-

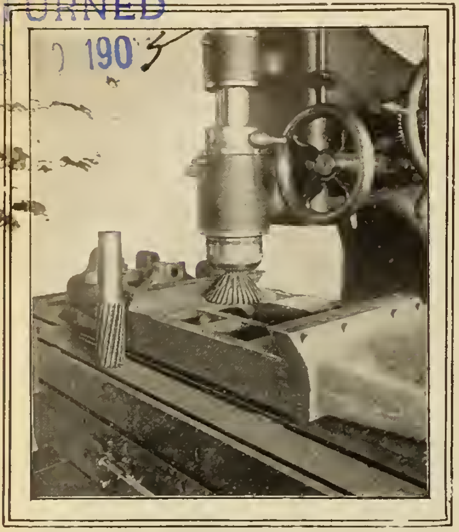


Fig. 4.

ed surface, every bad fit, every poorly matched gear, or every weak shaft leave their mark.

Some Methods.

As I have said before, no other machine has received such an amount of abuse and been able to survive, and on the other hand we find it petted to such an extent as to have fully as bad effects. In the latter case it is through ignorance of the machine's capabilities, it having been looked upon more as a necessary evil than as a help. In this case we find our friend merely turning over and over, grinding off the work—and cutter—this is so where the cutter is fed onto the work instead of into it. The remedy is to adopt as coarse a feed as the machine will stand, consistent with the grade of finish required. It is often on such trials as this that many base their opinions as to the value of the milling machine as a shop tool.

If we go into a well-equipped manufacturing plant—such it must be to be in competition—we will see not only one or two, but dozens of the milling machines in groups fairly pealing off the metal, leaving a surface that requires little or no finishing touches. It is in such plants as this that the milling machine is worked to its utmost, and is looked on as an important factor in the production of small parts.

I have in mind one firm in particular that had been using a grindstone to work their product, but upon the overpowering argument of an actual test were induced to abandon their old-fashioned method for the more modern and obviously the more economical. Many such cases could be shown where the milling machine has set a pace that has outreached any of its competitors.

Types of Milling Machines.

Milling machines are made in four different styles, not including the special styles such as the gear cutter, thread milling machine, rotary planer, etc.

The plain machine consists of a spindle set horizontally in an upright column. The column being fitted with a vertically adjustable knee, which carries the work table that has motion by power either parallel with or at right angles to the axis of the spindle, the latter motion being most used.

The Universal machine being similar to the plain machine, with the exception that the table, which is made to swivel in a horizontal plane, is fitted with a universal spirial and dividing head.

The vertical machine is also identical to the plain machine, except that the spindle is set vertically and perpendicular to the plane of the table. This style is on occasion fitted with a rotary table which is used in milling circular work.

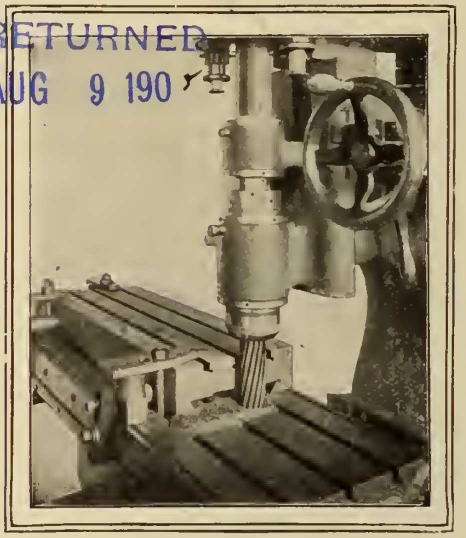


Fig. 5.

The planer type, as its name implies, is built on plans similar to the planer. Its general design varies with different builders in a much more noticable degree than with the three previous styles.

For general tool room work the universal machine is the one that would be installed. This machine is too well known to require any lengthy description, and should one be undertaken it would make an article complete in itself.

The scope of all milling practice was at one time, not so very long ago, limited to the universal machine, the output being small tools, such as drills, reamers, cutters, and gears.

Passing on to the plain machine, we come to a style that is showing what milling machines can do in competition with other machine tools on a range of work that is growing from time to time. We are asked how to tell without a thorough analysis of the details whether a machine is all that is claimed for it. A man who has a highly developed sense of fitness will realize on looking at a machine, or in fact anything for that matter, whether it is built so as to be consistent with the laws of nature. So used are we to the beauty with which nature surrounds us that we become excellent judges of such things, and even though we may not be able to suggest a remedy we are very much aware of the deficiencies. So the first impression which a machine makes on the mind will go a long way in either approving or condemning its design. This first impression may be modified on the appearance in actual tests or on closer examination. An important feature is the general layout, which may be such as to hinder the rapid handling of the work.

The plain miller of modern design can do work proportionate to its size, the amount of which is wonderful when we think of the slow, laborious processes previously used requiring the constant attention of a skilled mechanic. It must not be taken from this that the milling machine does not require skilled handling, far from it, but the skill does not all need to be expended on one job at a time.

One type of this style is what is known as the Lincoln type. It is most frequently found in the manufacture of small parts. It is not suitable for all around work, but for work which can be jigged to advantage and is within the range of the machine it is a most efficient and rigid tool. This type while it is not so easily adjusted and is somewhat restricted in range is favored on account of its being a powerful and rigid machine at a low cost. It is much used in arsenals, typewriter and small arms factories.

The vertical spindle machine has only recently come into general use, and may

Fig. 6.

yet be a novelty to some mechanics of the smaller shops. While the principle has been used for years in a machine shop, much used in locomotive shops,

the particular design was not adapted to general shop work. It remained for one John Becker, of Fitchburg, Mass., to so design a machine with a vertical spindle that would answer all the purposes of the general shop. Fig. 1 shows one of the latest productions in the line of vertical spindle milling machines.

It is easy to see that one of the advantages of this style is in having the part of the work under the cutter always in plain sight. This feature, together with the fact that the spindle is adjustable vertically make this the machine most suitable for all work that can be done with an end mill or face milling cutter, its great field being that of finishing machine frames which have a number of small surfaces scattered about.

When provided with a rotary table as shown in Fig. 1, we have a machine that can handle to advantage a great many jobs that are very difficult to do on a lathe. It has also proved, both in the matter of time and finish, that it can handle some of the jobs that are now considered typical lathe jobs at a pace that the lathe will find hard to equal. Such jobs are bevel gear blanks, worm gear blanks, hand wheels, etc.

For large work, such as that found in engine, locomotive and railway shops, we have the planer type machine. These machines are found in a variety of styles and sizes, some having horizontal spindles, others with vertical spindles, and still others with a combination of the above arrangements, all being in general design similar to the planer, hence the name. These machines are rapidly replacing the planer in a great many classes of work.

After going over the above it becomes quite evident that it will not be difficult

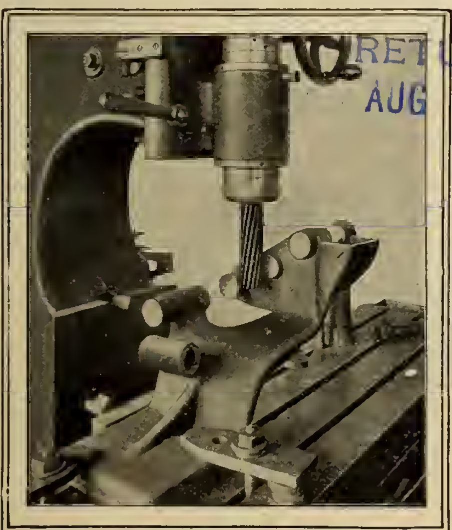


Fig. 7.

to fulfill condition 1, it being possible to choose a suitable machine for any class of work we may have to do.

Now that we have become somewhat familiar with the different machines, and have seen that condition 1 can be filled, let us pass on to the next condition.

Special Fixtures Advised.

We must have our machine equipped so as to be able to work it at the highest efficiency. In taking up the question of fixtures it may be well to settle now all possible argument as to whether it is necessary to have special fixtures in order that we may reap the good results.

Let the reader look at this matter in the same light that is taken in question of fixtures for any other machine tool, such as the drill press, for instance. What manufacturer would think of constructing machinery as they do to day, that is in groups or lots, without jigs for all work done on the drill press? Then why should he attempt to do such chine without suitable fixtures. But how many lose sight of this, and figure

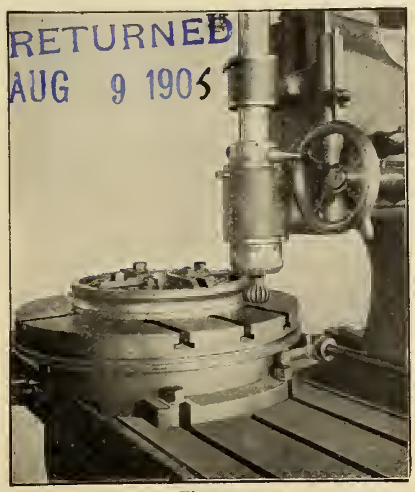


Fig. 8.

that they have accomplished all in the line of fixtures when they have a piece jigged for the drilling operations.

It is obvious that when we have the actual machining time reduced, as in the case of the milling machine, where it is practically at the minimum, that it becomes necessary to pay particular attention to the setting of the work, since it is here where we must make what ever gain we can in time. It is for this reason alone that it is necessary to have fixtures for receiving the work wherever we make any pretence at manufacturing.

It must not be taken for granted that the fixtures must be expensive tools, for as a matter of fact the simpler they are the better they answer the purpose. It is difficult to treat on the designing of fixtures for milling since each case must be treated individually and with special attention to its own peculiarities. But the designer must not lose track of the fact that rigidity and rapid handling of the work are the main objects sought. With this in mind and a desire for simplicity there should be no serious difficulty in designing very efficient tools.

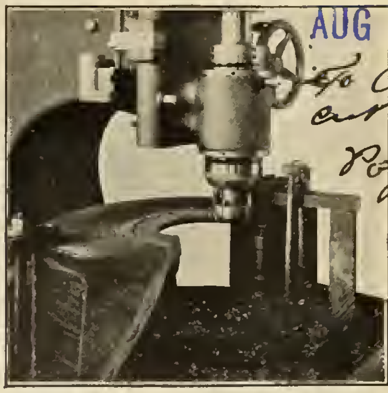


Fig. 9.

Examples of Work Done.

Before proceeding further it might be well to introduce here a few examples from practice which will serve to familiarize some with the great possibilities ahead of the milling machine as an important component in our progress.

Fig. 2 shows an example of surface milling on a vertical milling machine. Here will be seen the great advantage the vertical has over the horizontal machines for such work. The work is clamped in the table vise which makes a good fixture for this piece.

The absence of the excessive downward pressures, which are encountered where slabbing cutters are used, removes all danger of springing the work out of shape, thus insuring a perfectly true surface. Another advantage that the face mill has is in the smaller amount of power required to remove the same amount of stock as would a slabbing cutter. The heating of the work is also much less with this style cutter.

One style of work where a miller has shown its superiority over a planer is in working out dovetails. Examples of this work are shown in Figs. 3 and 4. Any machinist knows of the many accidents that are liable to occur while doing a job of this kind on a planer, such as the breaking off of the point of the tool, gouging in of the tool or shifting its position, causing a change of the angle, in any case spoiling the work. At best it means hanging over the work until the job is done, which is most tedious. The vertical miller simplifies this job to that of simply setting the cutter to the proper depth and throwing the shifter. Sounds easy, doesn't it? Well, I can guarantee that it will not take much longer than it takes me to write it. The cutter being ground to the proper angle, we are sure that the work will be done correctly so far as the angle is concerned.

It is best in most cases to take at

least two cuts, having both roughing and finishing cutters. It is also best to remove all sharp corners from the roughing cutter, as they are very easily worn off, causing the cutter to act as badly as if dull all over.

Fig. 10.

Fig. 5 shows the almost unlimited range that the miller has for such work. To do this job on a planer we would require one which would allow the piece to pass through the housings.

We have already mentioned that the great field that the vertical miller holds to the exclusion of all other machine tools is that of finishing machine frames. Figs. 6 and 7 are good examples of such work. The former shows an end mill in process of milling bosses of various heights. Fig. 7 is an example of milling with the periphiery of the cutter, and it is easily seen that the job can be done with the one cutter and with but one setting of the work. The shop man can estimate in his own way the time required to do this by both the old and new methods.

When we look upon the vertical miller as in competition with the lathe, we may find many interesting examples, the machine being equipped with a rotary table for doing this class of work. The work being clamped in a position corresponding to the diameter of the circular surface milled, the process being similar to the ordinary straight line milling.

The milling of the groove in the worm wheel blank, as shown in Fig. 8, and the example in Fig. 9, are two good examples of widely different character. Fig. 10 shows an example where the same cutter is used to mill the inner and outer conical surface of the rings shown. This insures absolute accuracy of fit. We might show many such examples, but have selected those that show at a glance the many advantages of milling as compared with other methods of producing the same results. In selecting all the examples from the vertical milling machine it was thought better to familiarize the shopman with this style, so that he may better judge its possibilities.

Cutters to Be Used.

Milling discounts planing in the production of duplicate work, it being possible to produce with the least amount of labor parts that will interchange. This is insured by gang milling. Here where we have a series of parallel surfaces of any sectional profile, the cutters are all placed on one arbor, as in Fig. 11, making but one setting necessary. Should the profile of the section be composed of other than straight lines we use what are known as formed cutters. These cutters are made the shape desired, and are so cut that they may be ground in sharpening so as not change their shape.

In selecting cutters it is best to have them as small as possible. It is also important to have the arbor of such a size to be able to resist the strains set up in milling.

For general use on a number 2 or 3 machine the arbor should not be less than one and one-quarter of an inch in diameter. Of course this may vary in special cases, but for all general purposes this diameter will be found to be the best. The harness or brace for the arbor is now made on the best grade of plain machines so as to require but one length of arbor.

Since the introduction of special high-speed steels, cutters have undergone many changes for the better. The fine showing made by this steel has forced the old carbon steel cutter to do some extra work in order to stand in the competition. But they have in a good many places shown that they are much more suited to the work than were the special steel cutters. For finishing work the carbon steel cutter has proven that they are best suited for this purpose, but when time spent in grinding and high speed are taken into account they have shown to be far inferior to the special steel cutters. Taken all in all, the tests that both cutters have had to stand have been all for the good, and have shown what could really be done with the old carbon steel cutters, which is far beyond the expectations of many advocates of the special steels.

It has been proved experimently that cutters for cast-iron act very much better when they have comparatively coarse teeth, but for work on steel, brass or composition, cutters may have finer teeth. This is the case since on cast-iron we use no lubricant which acts to wash away the chips as is the case with the other metals mentioned. Lard oil, or some good compound, are much used on steel, while soapy water acts best on brass and composition.

(To be continued)

WHAT THREE YOUNG FIRMS ARE DOING.

Ker & Goodwin, Brantford, Ont., have completed arrangements regarding assessment, etc., with the Brantford Council, and have under construction the erection of a brick machine shop which will enable them to double their staff and to largely increase their output. This firm has had much success in their endeavor to introduce a "Made in Canada" lathe chuck, all the dealers and most manufacturers being among their customers. When they are at work in their new shop they will manufacture 20-inch and 24-inch chucks, their largest now being 18 inches.

Krug & Crosby, machinists, Hamilton, have realized that to build up their business to large proportions they should engage in the manufacture of standard tools for the machine shop. They started first to manufacture hack saws and friction drills and have now added to this list a drill chuck which should meet with favor, owing to some new features, which will be described later in Canadian Machinery.

Taylor & Mackenzie, Guelph, Ont., though kept busy by a jobbing business of considerable importance, started some time ago to manufacture hack saws for the Canadian trade. The demand for these encouraged them to broaden out and inventive genius suggested to them the plans of a turret punch, which is described elsewhere in this issue and which should have a fairly wide field of usefulness. It is this firm's intention to add other lines as the opportunity occurs.

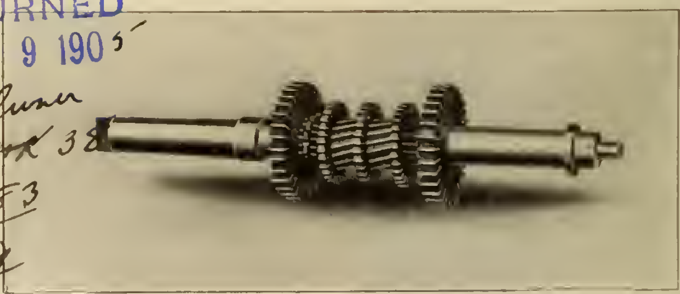


Fig. 11.

Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

REPAIR SHOP NOTES.

FOR testing out crosses in a commutator or an armature winding, I have found it a good plan to pass current through the armature by way of

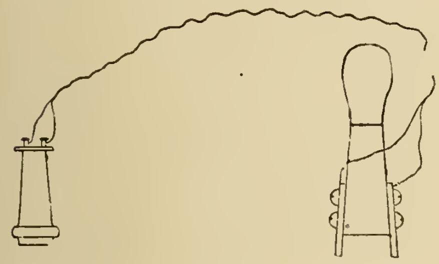


FIG. 1.

the regular brushes and to test each adjacent pair of commutator bars with a telephone receiver and a pair of contracts mounted on a block, as shown by Fig. 1. The brushes should be set exactly as they are for running, and the current controlled by some such means as a water or wire rheostat; ten amperes will usually suffice, and the current may he either direct or alternating The armature may he mounted on blocks or in its bearings. If everything is clear, a distinct hum will he heard in the telephone when the contacts arc pressed against two commutator segments; a cross between adjacent leads or commutator bars will cut out the humming entirely, while a cross within a coil will reduce it very perceptibly.

For testing out a ground, the terminals of the telephone receiver are connected to the two brushes of the machine and one of the brushes is connected to the frame (or the shaft, if the armature is taken out of the frame). The armature is then revolved slowly by hand, with current passing through from

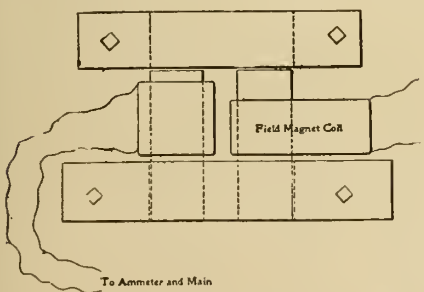


FIG. 2.

brush to brush; when the segment connected to the coil that is grounded comes in contact with the ungrounded brush, the telephone will be short-circuited and the humming will, of course, cease.

These tests are reliable and have the advantage that a voltmeter is not required; the use of a voltmeter involves the difficulty of watching the instrument and the test contacts simultaneously, not to mention the expense of buying the voltmeter if you happen not to have one.

The arrangement shown in Fig. 2 will be found very convenient and efficient for testing out short-circuits in field-magnet coils. It comprises a frame of laminated steel (transformer "iron"), the upper horizontal leg of which is removable. The core is 6 ins. x 8 ins. in cross-section and the horizontal pieces of it are 16 ins. long, leaving a clear space between the uprights of 4 inches. The

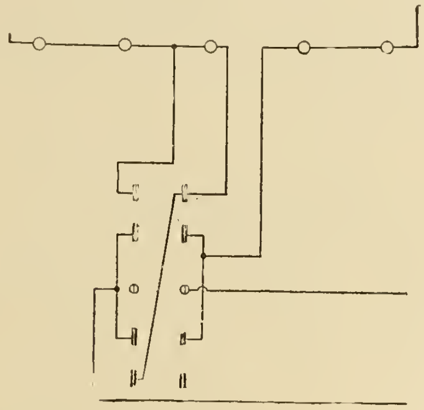


FIG. 4.

bottom piece is held between two pieces of hardwood which are bolted together beyond the ends of the iron. The upper member is similarly mounted, and in this case the bolts near the ends of the wood checks serve as handles by which to lift the leg. A coil consisting of 60

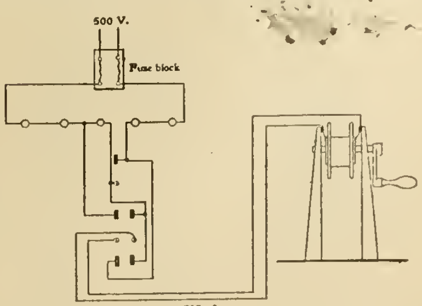


FIG. 3

turns of No. 5 magnet wire is slipped over one of the uprights and the field magnet coil that is to be tested is slipped over the other, as indicated roughly in the sketch. The magnetizing coil is connected to a 110-volt alternating-current in series with an ammeter, and if the field-magnet coil is sound, the ammeter will not show any more current with the field coil on the core than without it; any cross or short-circuit in the tested coil, however, will increase the ammeter indication, and if only a few turns are short-circuited the coil will immediately become hot.

Fig. 3 indicates a convenient method of taking either 100 or 500 volts from a 500-volt circuit for testing purposes. A double-pole, double-throw switch and a single-pole, single-throw switch are used to connect the testing leads either in series with a group of five (which are in series on the 500-volt circuit) or across the terminals of one of the lamps; the

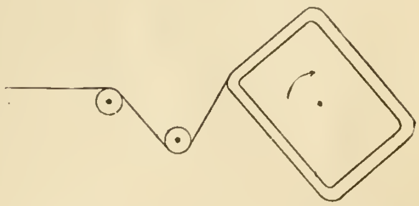


FIG. 5.

former connection, of course, gives 500 volts and the latter 100. The switches might advantageously be so mounted on a board that the handles would interfere with each other if not thrown properly, or a double-break switch might be used, as in Fig. 4; either plan would avoid any liability of an attempt to put the test leads in series with the lamps while the single-pole switch is closed.

The test leads are carried from the switch to two brushes on a reel frame which bear against slip rings on the sides of a reel, as indicated in Fig. 3; the inner ends of a duplex flexible cord are connected to the slip rings and the outer ends are carried to the work. The use of the reel avoids the nuisance of having a long length of cord lying about the floor when the work is near by.

In winding field magnet coils, two rollers located near the winding frame and arranged as shown in Fig. 5 will be

found of much help in counteracting the tendency of the wire to bow outward away from the layer beneath it. In taping a coil, it will be found of advantage to provide a wooden turn-table about 18 ins. in diameter surmounted by four blocks about 4 ins. square and 6 ins. long; the coil is laid on the blocks, and these are moved out of the way of the tape, one at a time, as the taping progresses.—American Electrician.

PURIFYING DRINKING WATER BY ELECTRICITY.

THE Frankfort News states that it is probable that electric purification of drinking water will soon be introduced into the home. This method, already used by a number of municipal waterworks, is based upon the germ-killing effects of ozone, which is cheaply engendered by electricity. If an electric discharge takes place between two glass tubes, one inside the other, whose surfaces facing each other are coated with metal, ozone is developed in the space between the tubes.

Electricians have tried in recent years to simplify the means of electric ozone development for purifying water. The ideal apparatus would be one which every housekeeper could put up in the kitchen, and by utilizing the electric current of the common electric light wires purify every glass of drinking water. According to the Frankfurter Umschau, such an apparatus seems to have been successfully made by a French engineer, Mr. Otto.

This apparatus is of very simple construction and takes up little space. It consists principally of a small, closed box, the metal cover of which is made conductory with the bottom. In the box is an ozone developer, an interrupter, and a tin tube. Through the latter the ozone, which first has to pass through a cotton stopper to free it from dust and germs contained in the air, is conducted into the water and mixed therewith. If much ozone has been absorbed, the water becomes phosphorescent in the dark. The most important part of the apparatus is the "mixer," action of which can be interrupted at will. The apparatus is capable of purifying about 60 gallons of water an hour, and the cost per hour is about the same as that of an ordinary electric incandescent light.—U. S. Consular Report, Frankfort, Germany.

TURN OIL TO ELECTRICITY.

POWER transmitted electrically from an oil engine has proved so technically and economically successful in its operation on a large vessel engaged in the transportation of oil 700 miles on the Volga to St. Petersburg that a second ship along similar lines is being built. The difficulty in making a good reversible and variable speed oil engine has limited its use to small motor boats, as the various kinds of reverse gears used extensively on the latter have proved impractical on large vessels. The introduction of electricity as the transmitting power between the engine and propeller shaft affords a means of simple and complete control of the boat. Ingenious controlling apparatus not only permits changing the motors from full speed ahead to full speed astern in twelve seconds, but places entire control of the ship under the hand of the man on the bridge, thus averting accidents occasioned by the failure of an engineer to execute orders promptly. Compared with steam the additional cost for electrical equipment requires it should show a saving of $1,000 a year, while in the instance of the boat mentioned, with petroleum at $9 a ton and coal $4.80, this amount was saved in two months in the reduction of the fuel bill alone. With the thermal units of crude petroleum about 11,000 calories per kilogram against 8,000 for coal, the oil shows 35 per cent. of effective work to 13 per cent. for coal. In addition to this economy, the installation of the oil engine and motors affords a gain of 10 per cent. in cargo capacity over that for steam.—The Draftsman.

ELECTROMAGNETIC SURGERY.

SOME remarkable instances of the use of powerful electro magnets have been known, among which might be mentioned a case in which a piece of a hammer head had been driven into the muscles of the upper arm, and another in which a piece of a chisel had become embedded in the forearm. The surgeons advised no operation, trusting that the pieces would work out of themselves; but, instead of this, the wounds festered, so an electro-magnet was tried. The result was completely successful, the pieces immediately appearing on the magnet.

Similar success attended the extraction of a chip of steel that had been embedded in the palm of a man's hand for one and a half years, another piece of steel that had been in the back of the hand for seven years, and a broken sewing needle that had caused much pain. In all these cases the particles appear to have made their exit through the channel by which they entered, and without any surgical operation.

The most suitable form of electromagnet for this purpose had a core 4 feet long and 6 inches in diameter, and was insulated with special cartridge paper. With this was used a current of 30 amperes at 110 volts pressure.—Scientific American.

COST OF ELECTRIC LIGHTING IN VARIOUS CITIES.

IN the Municipal Journal and Engineer for June, Mayor Fobes, of Syracuse, N.Y., presents statistics regarding street lighting in a large number of cities in the United States. Both private and municipal electric light plants are included in the list which is given below:

City.	Population.	Municipal or Private Plant.	Cost Per Arc Light Per Year.	Fuel Used.	Average Price Coal	Capitalization of Plant.
Albany	93,920	private	$117.80	coal	....	$2,000,000
Allegheny	138,018	municipal	68.89	coal	$1.88	....
Atlanta	96,550	private	75 00	coal	2.50	....
Baltimore	531,313	private	99 92	coal	3.20	2,700,000
Boston	594,618	private	124 10	coal	....	10,500,000
Bridgeport	77,635	private	82.00	coal	....	....
Chicago	1,873,880	municipal	75.00	water	...	....
Cincinnat	332,234	private	96.00	coal	3 75	700,000
Cleveland	414,950	private	61.36	coal	2.75	1,650,000
Columbus	35,487	municipal	66.00	coal	1.75	31,000,000
Dallas	44,159	private	73.56	coal	1.30	2,500,000
Denver	141,528	private	54.36	coal	2.75	1,650,000
Detroit	306,653	municipal	35.00	coal	1.40	485,000
Elmira	37,106	private	[illegible]3.00	coal	2.00	....
Fall River	114,004	private	90.00	coal	3 00	3,250,000
Grand Rapids	21,630	municipal	61.65	coal	2.58	819,506
Hartford	87,863	private	80 00	coal	3.00	....
Indianapolis	196,039	private	109.50	coal	4.13	350,000
Jersey City	212,462	private	70.95	coal	2.85	45,000
Kansas City	173,064	private	70.00	coal and water	4.00	1,900,000
Louisville	215,402	private	74.00	water	....	....
Lowell	100,150	private	97.50	water	....	......
Lynn	72,350	private	65.00	coal	3.00	....
Memphis	113,669	private	84.00	coal	....	....
Minneapolis	214,113	private	120.45	coal	....	....
Nashville	82,711	municipal	98.55	....	....	....
New Bedford	68,955	private	85.00	....	...	....
New Haven	114,600	private	94.00	coal	3.00	....
New Orleans	360,625	private	45 00	coal	1.79½	200,000
New York	3,766,139	private	98.55	coal	....	845,000
Omaha	113,361	private	82.12½	coal	3.73	1,000,000
Paterson	113,267	private	77.00	coal	3.25	..
Portland, Ore	98,655	private	145.00	coal	....	85,338,000
Providence	189,142	private	91.50	coal	....	....
Reading	85,051	private	101.00	water	....	..
Richmond	86,148	private	63.60	coal	3.80	5,000,000
Schenectady	43,538	private	109.50	coal	1.75	......
Scranton	107,026	private	85.00	coal	2.91	..
Seattle	92,020	private	34.00	water	....	80,000
St. Joseph	110,479	municipal	72.12	coal	1.22	300,000
St. Paul	172,038	private	66.00	water	...	..
St. Louis	612,279	private	95.00	coal	1.60	102,000
Toledo	145,901	private	98.00	coal	2.00	10,000,000
Trenton	76,766	private	83 00	coal	2.45	.
Troy	75,867	private	118.62	water and coal	...	2,000,000
Utica	60,097	private	116 18	coal	2.50	2,000,000
Washington	298,217	private	85 00	coal	3.00	....
Wilmington	81,300	private	......	coal	6.00	.....
Worcester	128,552	private	108.00	coal	4.75	800,000
Yonkers	52,701	private	109.50	coal	....	300,000

TAPING.

THE most obvious use of tape is to provide a permanent mechanical separation of conducting materials and to maintain a gap between two conducting wires, or a wire and the ground, which might be done by any non-conducting material, even wooden blocks. A good quality of tape, however, not only prevents the lodging of small conducting particles and dirt, but actually increases the dielectric strength of the gap. In other words, a good insulating tape will considerably increase the effective length of an air gap. For instance, 10,000 volts will puncture an air gap of approximately ¼ inch between spherical terminals. If the same air gap be filled with impregnated linen tape more than 40,000 volts will be required to puncture. A sheet of treated cloth 0.01 inch thick will stand a puncture test of from 4,000 to 10,000 volts, while 10,000 volts will puncture almost ½ inch of air between needle points.

Kinds of Tape.

Generally speaking, there are three classes of tape—(1) untreated cloth, (2) rubber, (3) treated cloth.

Untreated cloth tape may be of any fabric, such as linen, cotton or silk. When this tape is kept perfectly free from moisture it forms a good insulation. Its chief advantage, however, is its mechanical strength, which admits of rough handling during the taping process. After it is in place it is usually treated by brushing with or dipping in varnish or some other insulating compound. This increases the dielectric strength and prevents the absorption of moisture.

Rubber tape may be divided into two general classes—(1) those tapes without any cloth or other supporting body, (2) those with some supporting body. The first class of rubber tape is made up from a rubber compound. It is relatively thick, but being quite elastic the operator is enabled to obtain varying thicknesses by stretching. It is best adapted where the voltage is high and where there is plenty of room for insulation. In splicing rubber-covered cables this tape secures for the splice practically the same insulation as is on the body of the wire. The second class of rubber tape may be obtained in a variety of forms, the most common of which are viscous tapes. These tapes are sticky at ordinary temperatures. They adhere readily and, after drying for some time, become quite hard and offer considerable mechanical support. Viscous tapes vary considerably in thickness and cost, depending on the materials used in their manufacture.

Treated or varnished cloth tape may be sticky, or it may have a smooth, hard surface; it usually requires some binding material to hold it in place. Its insulating property is very high and, being very thin, it is well adapted where space is valuable, especially in insulating wires in slots of machines. However, it is not very strong mechanically and should not be used on rough or uneven surfaces, or where it is likely to be subjected to mechanical strains.

Moisture Protection.

A taped joint or conductor should be moisture proof. To insure this the tape should be wound very firmly. A good joint should be made between the tape and the insulation of the wire. In taping a splice the metal surface should be smoothed, using a file if there are sharp points or corners left from soldering. The surface should then be sandpapered slightly and wiped with a dry cloth to remove all dirt, dust and soldering fluid. The kind of tape used in any case will be determined largely by the space in which the conductor is confined. As a rule, a thin viscous tape is used on all ordinary work which is subjected to moderately low voltage. When the voltage is high and the insulating space is very limited, and especially where the conductor comes in contact with the iron parts of a machine, the conductor should be taped with treated cloth and finished with a taping of untreated cloth, and then the whole thoroughly shellaced or varnished.—Electric Club Journal.

THE PRODUCTION OF MICA.

MICA in its indifference to high temperatures and non-conductivity to electricity possesses physical characteristics which give it a unique position as an article of commerce, particularly in relation to electrical work for insulation purposes, and in minor degrees for lantern slides, negatives, and as a base for paints and explosives. Among other things, the mineral is distinguished by a particularly wide range of geographical occurrence, as also by a large series of mineralogical forms.

The three most valuable occurrences of mica are muscovite, phlogopite and biotite. The first mentioned, which is found in a variety of colors, is mined in India, and in lesser degree in German East Africa and Brazil. Phlogopite is worked in India, Ceylon, Canada and Brazil. In order of importance the three chief producing countries are British India, Canada and the United States. The exports of the Indian mines in recent years are: 1902-3, 20,412 cwts., valued at $426,595; 1903-4, 21,548 cwts., valued at $420,275.

From the technical point of view, Canada affords the most interesting field for inquiry, since it is here that efforts are being made to work the mineral on a substantial and organized scale, and not merely from hand to mouth. The existence of an unlimited supply of cheap labor has occasioned a singular crudity of method in the Indian mines. Although the finest quality, as well as the largest quantity, comes from the peninsula, the proportion is carried on absolutely without the use of machinery, the mineral and the waste material being passed to surface in small baskets by long lines of women, and unwatering operations being carried on by means of jugs.

Throughout the American continent, practice, although more modern, is still, owing to a variety of causes, of an archaean type. Miners in this branch seem peculiarly prone to the vice of dividing their profits up to the hilt, no proper development work being carried on excepting in certain well-known cases. In Canada the open quarry method is still largely followed, notwithstanding the dangers occasioned by the heavy frosts.

In the Lacey mine, Ontario, however, modern machinery is used and the example of adopting the power-drill has been furnished. A high proportion of waste occurs, the finished product averaging only some ten to twenty per cent. of the output. It is hoped, however, that with improved methods of treatment the proportion may be made less disadvantageous.

The Canadian output at present shows an inclination to decline, being valued at $166,810 in 1903 and $159,175 in 1904, though estimated as high as $410,960 in 1902. The American output, which is chiefly small mica—the quality most affected by tariff conditions—shows a steady decline in value since 1900. The decline in values at the end of the century was due to a sudden demand for small mica for the micanite industry, which, of course, lowered the average quality of the mineral exported. The industry in India employs about 9,000 persons, and is worked on a $1.25 gross royalty basis.—Mining World.

BUFFING ROOM PRACTICE.

THE buffing room in the brass department at the new Angus shops of the Canadian Pacific Railway, Montreal, presents an interesting illustration of recent advance in the removal of dust from buffing and grinding wheels. Here a Sturtevant exhaust fan with a special form of Sturtevant hood enclosing the wheels insures the withdrawal af all of the dust and fine chips. This system maintains a perfectly clear atmosphere within the room, separates the chips from the dust and prevents the discharge to the outer atmosphere of dust-laden air with the attendant disagreeable results.

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

HEADS OF MACHINE SCREWS.

THE size and shape of machine screw heads as made by different manufacturers vary very greatly. In the case of screws made by some manufacturers the heads used on different sizes have different proportions, thus presenting a different appearance. The company with which the writer is connected is a large consumer of machine screws, and this variation has from time to time caused great inconvenience. Frequently designs are made to suit the screw heads of one manufacturer, and if afterward it becomes desirable to purchase screws manufactured elsewhere there may be an interference with other parts of the machine due to the variation in size of heads. When fillister head screws were used with the space for the heads counterbored it was necessary to make the counterbore large enough to take the maximum size of head, thus not making a good appearance when smaller heads were used. The same was true in the case of flat-headed machine screws. The subject was taken up with several manufacturers of machine screws and it was found that they had no defined standard, but were open to suggestions and were willing to supply screw heads to any ordinary dimensions without much if any extra cost. The extreme variation in dimensions found is shown graphically in the accompanying drawings by full lines, from which it will be seen that there is great irregularity, and, as stated above, the same manufacturers will in some cases supply larger heads proportionally than others. (See Figs. 1, 2 and 3.)

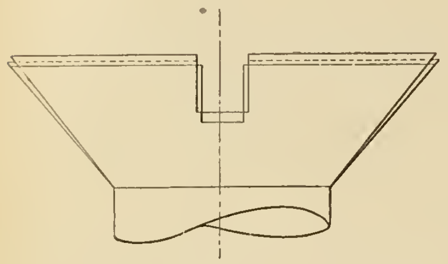


Fig. 1. Present Variation and Proposed Design for Flat Head Machine Screws.

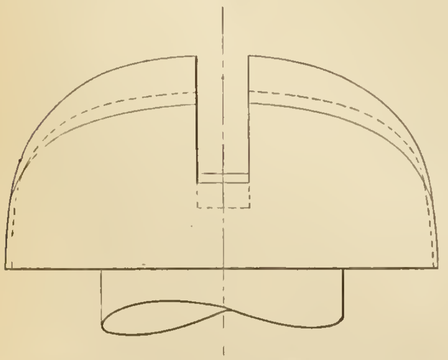


Fig. 2. Same for Round Head Machine Screws.

In order to establish uniformity in our own works we prepared the accompanying formula and table giving the shapes and dimensions of the heads of the size of screws ordinarily used. The shape and proportional dimensions of these heads are shown by the broken lines in the drawings of the several forms of screw heads. It will be seen that these heads present a uniform appearance, and by submitting the table of dimensions we have had no difficulty in obtaining screws to the dimensions shown—in fact, the manufacturers have expressed themselves as pleased to have a standard to work to.—Read at Scranton Meeting American Society Mechanical Engineers.

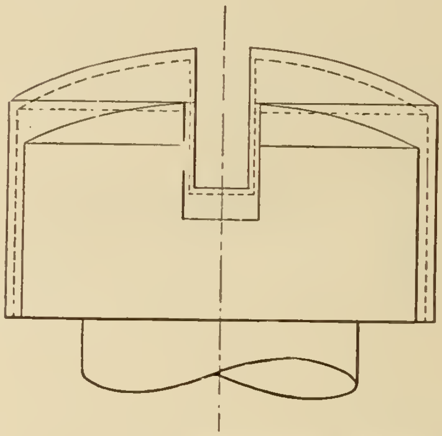


Fig. 3. Same for Fillister Head Machine Screws.

TYPES OF CENTRIFUGAL PUMPS.

CENTRIFUGAL pumps were known as early as the seventeenth century. Papin, the celebrated French engineer, designed a centrifugal pump in 1703. Euler brought out a pump of this type in 1754. In 1818 a form of centrifugal pump was brought out in Massachusetts, U.S.A., known as the Massachusetts pump. In 1830, a Mr. McCarthy erected a pump in the New York Navy Yard, which was credited to have approached the efficiencies of the present day. In 1846 Andrews produced pumps of this type and about the same time John and Henry Gwynne, in England, commenced the manufacture of centrifugal pumps as a commercial enterprise. Appold exhibited a model of a centrifugal pump at Birmingham in 1849, and at the Crystal Palace Exposition in London, in 1851, Appold's pumps were an important feature.

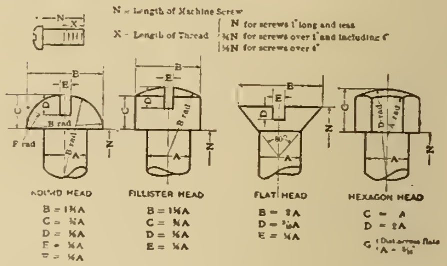


Fig. 4.—Formulas for the Design of Machine Screws After the Proposed Standard.

All of the pumps above referred to had a single impeller or runner. Some of these pumps had the suction upon one side only, and some, like the Massachusetts and Gwynne pumps, had double suction inlets or openings on both sides. All of these pumps were made for comparatively low lifts and large quantities of water and did not have very high efficiencies.

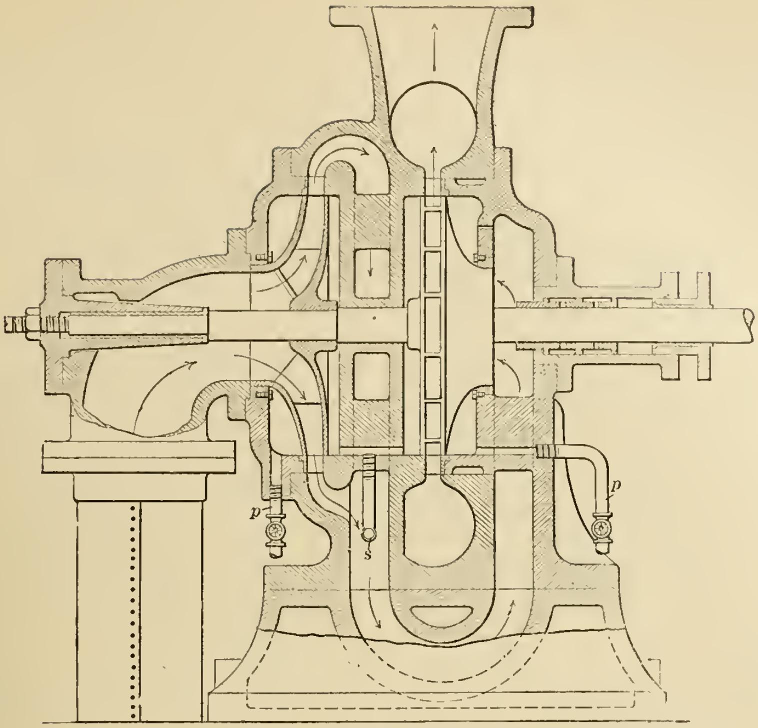
Appold in his experiments determined that the efficiency depended mainly upon the form of the blades of the impeller or vane and the shape of the volute or enveloping case, and that the best form for the blade was a curve, pointing in the opposite direction to that in which the impeller revolved, and for the case, that of a spiral tapering type or volute.

All the early pumps designed were constructed originally with the impellers facing in one direction, and the consequent thrust upon the impellers was partially taken up by balancing chambers upon the rear of each impeller. This form of balancing was further improved in Rateau's pump by a balancing cylinder at the extreme discharge end of

DIMENSIONS OF STANDARD MACHINE SCREWS.

Size of Screw	No. of Threads	Round Head Dimensions						Fillister Head Dimensions					Flat Head Dimensions			
		A	B	C	D	E	F	A	B	C	D	F	A	B	D	E
0		058	108	044	029	015	029	058	087	044	029	015	.058	.116	017	.015
1		071	.124	053	.036	.018	036	.071	107	053	036	018	071	142	021	018
2	64	085	154	064	044	022	044	085	128	064	044	022	085	170	026	022
3	48	099	173	.074	050	025	050	.099	.149	.074	050	.025	099	198	030	025
4	36	113	198	085	057	028	057	113	170	085	057	.028	113	226	034	028
6	32	141	247	106	.071	035	071	141	212	106	071	035	141	282	042	035
8	32	166	291	125	083	042	.083	166	.249	125	083	042	166	332	050	042
10	32	190	333	143	095	048	095	190	285	143	095	048	190	380	057	048
12	24	221	387	166	111	055	111	221	332	166	111	.055	221	442	066	055
14	24	246	431	185	123	062	123	.246	369	185	123	062	246	492	074	062

Size of Screw	No. of Threads	Hexagon Head Dimensions			
		A	C	D	G
14	24	246	246	492	431

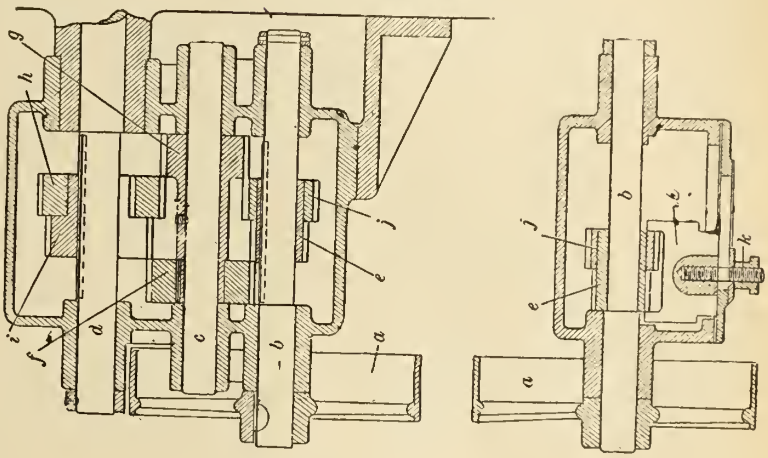


Balancing Richards Pump.

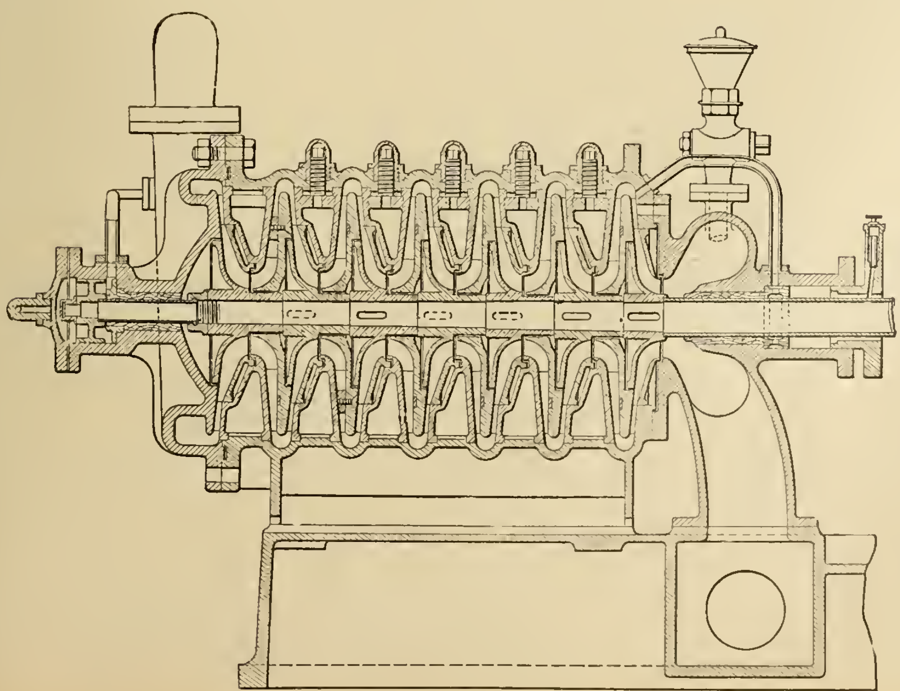
John Richards also used a balancing piston at the discharge end of the pump, directly connected with the discharge pressure, as shown in Fig. 2; and also attempted to further balance a pump of this type by exhausting the air from one side of the impeller and forcing air in upon the other side.

Sulzer made the greatest step in the balancing of compound pumps by placing the impellers back to back in pairs, so that one impeller thrust in one direction and the other in the opposite direction. The method which he followed, however, of conveying the liquid being pumped from one impeller to the next, required short tortuous passages, as he utilized the fixed guides of the whirlpool space of the pump to form these cross-over passages. It is believed also that to Sulzer we are indebted for the idea of introducing the guide blade or turbine element. John Richards followed Sulzer in placing two impellers back to back and differed from Sulzer in passing the discharge from one impeller out and around the discharge chamber of the final impeller, but showed this construction only in a two-stage pump.

the pump shaft, into which water was admitted from the discharge orifice of the pump. This is clearly shown in Fig. 1. Rateau further attempted to improve the balancing of his pump by constructing inclosed impellers, having one of the side plates of the impeflers of smaller diameter than the other, so that the areas of the two impeller side plates subjected to the discharge pressure from that impeller were equal. This will be understood from Fig. 2. The diameter D is enough smaller than the diameter E, so that the area of the side plates under discharge pressure at (a) will be equal to the area under discharge at (b).



Detail of Change Gear Box.



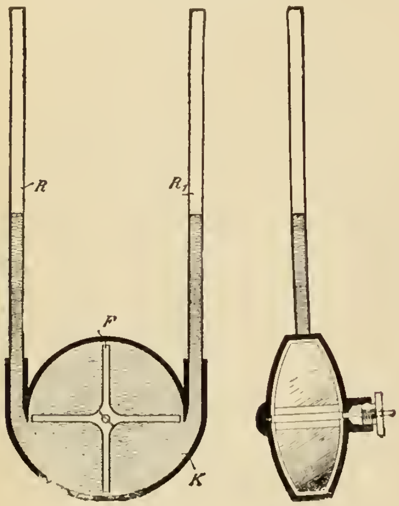
Balancing Rateaus Pump.

It is the opinion of the writer that in a properly constructed pump no thrust, residual or otherwise, should be left over or unbalanced, and he believes that he is the first one to design an absolutely balanced compound centrifugal pump, by causing the impellers to be placed back to back, but not in pairs serially disposed, and in producing results from the method in which he sequentially connects the different impellers, so that both the sum and difference of the suction and discharge pressures of all the impellers in any compound centrifugal pump equalize and balance each other.—Cassier's Magazine.

The Superior Manufacturing Co., rubber and steel stamp manufacturers, have just added a large stock of white enamel letters to their business. This is a new line this firm is branching out in, and one that promises great results.

NEW METHOD OF TESTING LUBRICANTS.

Lubricants are employed to prevent contact and minimize friction between rubbing surfaces, especially revolving mechanical parts. They thus lessen heating, waste of power, and wear. To prevent direct contact the lubricant must be sufficiently viscous to withstand the pressure on the bearings. The temperature is naturally higher at the points where oil is most needed, and with increasing temperature the viscosity of most oils diminishes very rapidly. Different oils have also widely differing internal frictional resistances, which are greatly affected by the temperature and velocity of the rubbing surfaces. Internal friction resistance increases the amount of heat generated by the friction in the bearings; hence oils with minimal internal frictional resistance should be chosen. These considerations show the importance of testing



Apparatus for Testing Lubricants.

lubricating oils with regard to both their viscosity at particular temperatures and their internal frictional resistance at particular temperatures and velocities.

In some cases the thickness of the oil is the more important factor, in others the internal frictional resistance. In the few main bearings of large machinery less importance attaches to the internal frictional resistance than to the requisite viscosity of the lubricant at the highest temperature likely to occur, so that a sufficiently thick supporting layer between the rubbing surfaces will be maintained in spite of the high pressure on the bearings; for in this case the loss by friction is of little moment in comparison with the total output of power. In other cases, however, where the losses due to friction in the bearings constitute a large proportion of the entire power consumed, as, for example, where extensive shafts drive numerous small machines, any slight addition to the frictional resistance at each bearing surface has a marked influence upon the total consumption of power. This, of course, affects the economy of working, and in such cases an oil should be chosen which minimizes the frictional resistance.

For the purpose of determining these two characteristic physical properties the Gehruder Korting Electrical Co., Limited, Berlin, have devised an important method of testing lubricants. The following description will serve to give a clear idea of the machinery used. In figure 1, K is a closed chamber which is filled with the lubricant to be tested. Within this chamber a fan F is made to rotate, the driving shaft projecting from the side of the chamber through a stuffing box. The fluid in chamber K has two communicating tubes, R and R1, fitted to it, in which the lubricant rises about to the middle. When the fan is started the oil in the chamber is compelled to participate in the motion, and hence friction is established between the moving portion of the lubricant in the chamber and the stationary portion in the tubes. The frictional resistance thus produced causes the oil to rise in one tube and to fall in the other. The difference in the levels of the fluid columns, taken in conjunction with the specific gravity and temperature of the oil and the velocity of motion, affords a measure for the internal frictional resistance of the lubricant.—U. S. Consular Report, Eibenstock, Germany.

ANALYSIS OF PRODUCER GAS.

The use of the following apparatus, designed by Professor N. W. Lord and shown in the figure, is advised.

B is the sampling tube, made of 0.5-inch pipe which is placed in the gas flue; A is an annular jacket surrounding B, and has pipe connections at D and C.

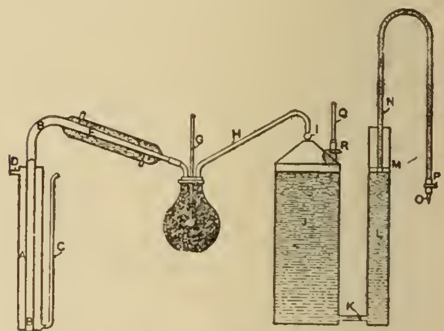
Live steam is blown in at D, and out at C, the object of this being to keep the temperature of the iron pipe, B, below the point at which the iron would act on the CO_2. This will secure a sufficient cooling and yet will leave the temperature high enough to prevent the condensation of moisture.

E is an ordinary condenser through which cold water is circulated.

F is a small flask filled with ignited (Note A) asbestos fiber and containing a thermometer, G.

Note A.—Ignited asbestos fiber means fiber that has been heated red hot to drive out all the moisture and grease.

J. and L are tanks filled with water and connected at K. I is a valve. H is a rubber tube connecting J and F. Q is a thermometer placed in a stopper in a pipe with valve, R, the object of this valve being to make it possible to remove the thermometer, when gas is in the tank, J. M. is a float to which is fastened the curved glass tube, N, which acts as a siphon and which has a small nozzle, O, with a pinch cock, P, on the rubber connection. The object of the float and glass tube is to keep a constant head above the nozzle, and thus insure a uniform flow through it. The operation of the apparatus is as follows: Disconnect the rubber tube, H, and fill the tanks, J and L, with water until it overflows at the valve, I; fill the siphon, N, with water and close the stop cock, P; attach the rubber tube, H, with stop cock, I, and circulate water through the condenser, E, and steam through the water jacket, A. Then open valve, P; the water will be drawn out of tanks, L. and J, and the gas will be drawn through condenser, E, flask, F, and tube, H, into the top of the tank, J. The water in excess of the saturation of the gas at the temperature of the small flask is condensed and any tar


Arrangement for Sampling Gas.

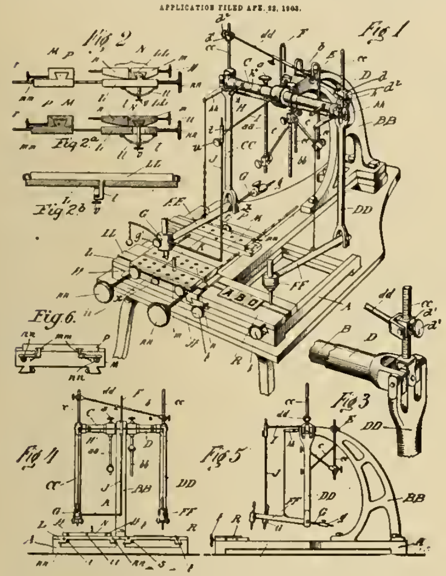
and soot in the gas retained in the ignited asbestos in the flask. After the test, the flask and its contents are weighed and the increase over the weight taken before the test gives the quantity of the tar and water condensed from the volume of the gas which has passed through the flask. This volume is determined by measuring the quantity of water which had run out of the aspirating tank, J, which had been used in drawing the sample.

The quantity of water remaining in the gas, after passing out of the little flask used as a receiver, is then calculated from the temperature of the issuing gas, which was saturated with water vapor, by the ordinary saturation tables. The water in the gas is then the sum of the permanent vapor and that condensed. The water in the flask is determined by drying the contents over sulphuric acid to constant weight and determining the loss. The dry contents are then heated red hot and the further loss of weight estimated as soot and tar.—Gas Power.

Recent Canadian Patents

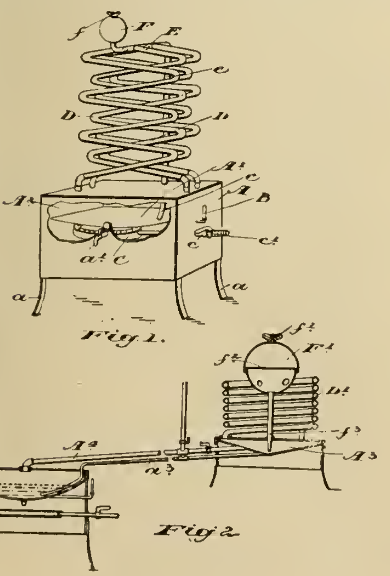
Engraving Machine.

PATENT No. 709328, issued to Frank M. Swayze of St. Davids, Ont. This invention relates to improvements in engraving machines, and has



Engraving Machine.

for its object to provide a simple and efficient construction by which metal or other engravable substances can be neatly and quickly engraved. The particular features set forth comprise a standard and axle, sleeves, revoluble on the axle, tracer and graver arms connected with each other and to said sleeves, scale arms pivotally connected with the sleeves and tracer and graver arms, adjusting means connecting said scale arms, scale arms movable with



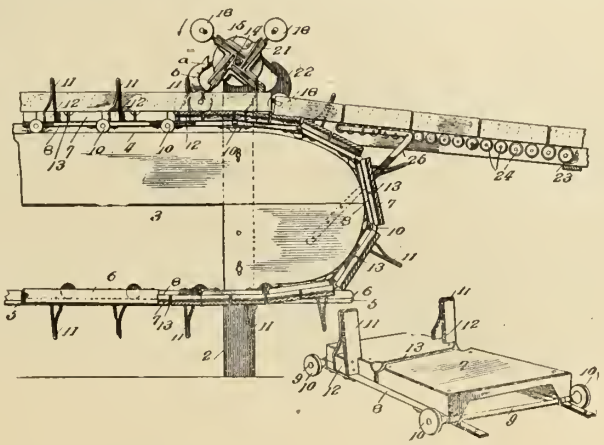
Portable Steam Radiator.

the sleeves, additional scale arms connected to move together and means adjustably connecting said additional scale arms to the scale arms which move with the sleeves. The illustration shows a perspective view of the entire machine, illustrating its different parts, accompanying which is a view of spring locking device associated with the machine.

Portable Steam Radiator.

Patent No. 788705, issued to Helen Harriett Cook, Toronto. It relates to improvements in portable steam radiators and the object of the invention is to devise a radiator of this class whereby the heat may be applied directly underneath the radiator itself, or in close proximity thereto, so that all the units of heat may be utilized to the greatest extent and thus fuel economized. It consists essentially of a casing supported on suitable legs and provided with a hot water receptacle on the top, and the gas heating means for such receptacle located beneath it, and a plurality of coils extending from the top of the casing to a condensing bulb and a pipe leading from the condensing bulb to the water receptacle, the parts being otherwise arranged and constructed in detail. A perspective view showing the approved individual radiator is given.

Brick, Block or Tile Cutter.

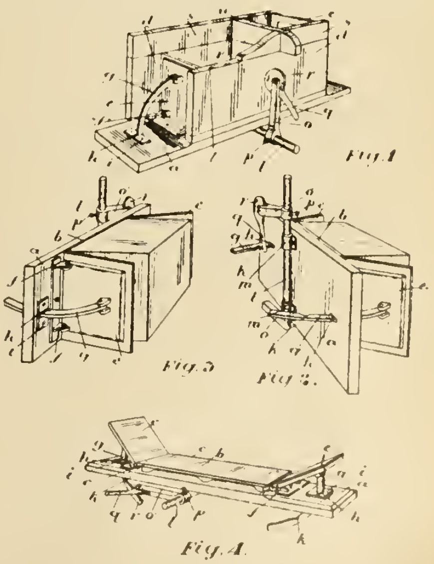


Brick, Block or Tile Cutter.

Patent No. 790170, issued to Byron E. Bechtel, Waterloo, Ont. This invention relates to certain improvements in bricks, block or tile cutters. It consists in certain novel features in construction and in combinations or arrangement of parts. A vertical longitudinal section of the rear portion of the machine is shown and a detail perspective of a portion of the endless carrier or table. The machine comprises an endless traveling table made up of loosely connected plates or sections, a frame providing tracks or ways for the table, a rotating cutting reel driven by engagement with standard rigid with the table sections and a roller bed or platform to receive the cut bricks discharged from the table.

Mould For Cement Blocks.

Patent No. 787375, issued to Frank Gutteridge, of Seaforth, Canada. This invention relates to a portable mould for the manufacture of that class of building material known as cement blocks. Figure 1 is a perspective view of the mould-box, showing the side and end members in their enclosed position. Figure 2 is a perspective view showing the mould-box upset to deliver the moulded block, with one of the side members removed and both end members opened, so as to be moved out of contact with the moulded block. Figure 3 is a similar view to figure 2, but looking at



Mold for Cement Blocks.

it from the opposite side. Figure 4 is a perspective view, showing the bottom and end of members of the mould-box.

Construction and Improvement

General Construction *Contractors' Supplies*

A NEW BUILDING.

A NEW building material has been invented by a Russian engineer. It is called uralite, evidently in honor of the valley of the Ural, from which district the young Russian comes. It is said to be far superior to anything of the kind ever before placed on the market, as it takes the place of both wood and stone. It is also absolutely fire-proof.

Uralite is composed of asbestos fibre, with a proper proportion of silicate, bicarbonate of soda and chalk, and it is supplied in various finishes and colors, according to the purpose for which it is intended. In a soft form a sheet of uralite is like an asbestos board: when hard it resembles finely-sawn stone and has a metallic ring. Besides a non-conductor of heat and electricity, it is practically water-proof (and may be made entirely so by paint), and is not affected either by atmospheric influences or by the acids contained in smoke in large towns, which rapidly destroy galvanized iron. Moreover, it can be cut by the usual carpenters' or woodworkers' tools; it can be veneered to form paneling for walls or partitions; it can be painted, grained, polished and glued together like wood; it does not split when a nail is driven through it; it is not affected when exposed to moisture or great changes of temperature, and it can be given any desired color either during the process of manufacture or afterward.

A NEW CEMENT.

CEMENT manufactured from chemical refuse is the latest evolution of the trade in England. The immense waste heaps composed principally of sulphate of lime, which are to be seen at many of the chemical works in England, are to be used in making this new cement. The process consists of re-crystallizing this waste into a patent white cement, which gives a perfectly smooth surface, with a polish similar to glass and yet sufficiently porous to take paint. This cement can be used for the same purposes as other cements and is said to have an advantage in it, that whilst they require a backing of Portland cement, it can be used with Portland or backing of two parts sand and one part of the plaster itself. Other advantages claimed are that it takes less time to spread with the corresponding saving in labor and wages. This cement has been tested at the hydraulic cement works and it created much surprise by standing a tensile strain nearly equal to the best hydraulic cement.

FIRE LOSSES IN 1904.

THE annual fire waste is a serious problem, for in spite of all precautions that are being taken in modern building construction and the wide adoption of every improvement in the way of fire prevention and fire fighting, the losses from this cause are growing steadily from year to year. In the last calendar year the total fire losses for the United States and Canada, as compiled by the New York Journal of Commerce, reached a larger sum than for any preceding year, with the single exception of that of the great Chicago conflagration, 1871. The aggregate fire waste for the 12 months is figured in excess of a quarter of a billion dollars, the actual amount being 252,364,000. Of course this sum was immensely swollen by the $70,000,000 loss involved in the Baltimore fire of February and also by the $12,500,000 loss in Toronto, Canada, and a serious fire in Rochester, N.Y., which involved a loss of $3,200,000; but, eliminating these three sums, the total of the smaller and moderate fires is still found to be greatly in excess of that of any recent year, being $166,664,000, as compared with $137,365,000, the average for the ten preceding years. The effect of these great losses has been disastrous to the fire insurance business, resulting in the retirement in Baltimore of all but three of the local insurance companies, while a number of smaller companies throughout the country have also given up the struggle during the year. No less than 3,100 fires occurred in 1904, each of which represents an aggregate loss of over $10,000, as against an average of about 2,100 fires of similar range in preceding years. From the fact that these losses represent to a large extent the absolute wiping out of property and wealth it will be seen how serious a drain on the country's resources the annual fire losses represent.

A COMMON RESULT IN ESTIMATING.

BUILDING has become so highly developed and specialized that the cost of omitting work has become an important item in making estimates. Not long since a factory obtained a contract for furnishing the outer and inner wood finish of a chapel, says a writer in a recent issue of the Western Builder. Specifications for the outer work required that it be without "surfacing" or planing, as the saw left it. The office man who "billed" the work to the factory took pains to mark all over the lists and drawings that the stuff was to be planed on the back side only—this to bring it to a proper thickness—and that all exposed surfaces were to be left as sawn. In due time, chancing to be in the warehouse, he saw, stacked up ready for shipment, all this outer finish fully dressed and planed, and of course it all had to be thrown away. It is safe to say that the next time the managers of the factory estimate on work in which the surfacing is to be omitted they will add something to cover the chance of having to do the work over again.

A FIREPROOF BUILDING.

THE new building which is being erected for George W. Reed & Co., Montreal, is the first of its kind to be erected in the City of Montreal. The floors, pillars, beams, walls, steps, stairs, and partitions are made of concrete, being built on the Kahn reinforced system. The window sashes and frames are manufactured of galvanized iron, wire glass taking the place of plain window glass. The doors are made of wood covered with galvanized iron. Each door is attached to a heavy weight by means of a rod secured to a hook on the door which is manufactured of soft material. This weight allows the door to work easily while in use, but should a fire originate in the building, the least amount of heat will melt the small hook which secures one end of the rod, thereby allowing the weight to drop and forcing the door forward at such a speed which will result in it becoming securely locked and thus barring further progress to the fire. In other words, everything is being done which will in the future ensure perfect safety.

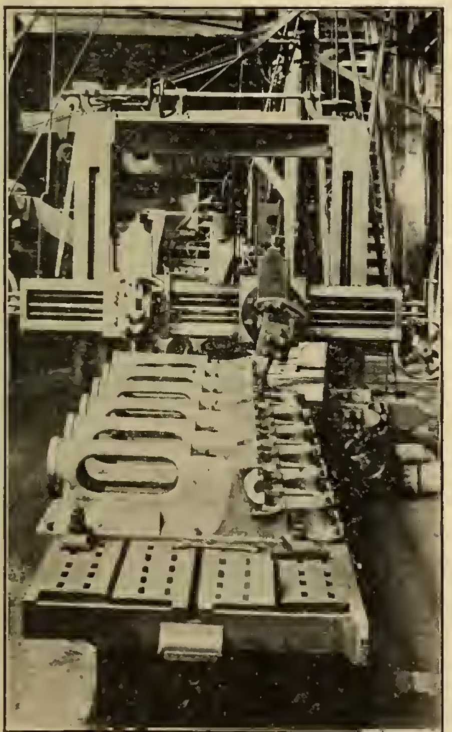
Economic Shop Practice

By Progress

INDUSTRIAL progress in Canada up to the last few years has been steady but slow. In consequence thereof we find that the older shops, which invariably sprung from very small beginnings, are building a large variety of machinery for different industrial branches, resulting from the endeavor to keep their men and shops busy all the year round and adding one line of machinery after another as necessity demanded their doing so.

There are quite a number of shops employing three hundred and six hundred men building boilers, engines, wood-working machinery, saw-mill machinery, flour-mill machinery, brick machinery, etc., etc., all under one roof and management.

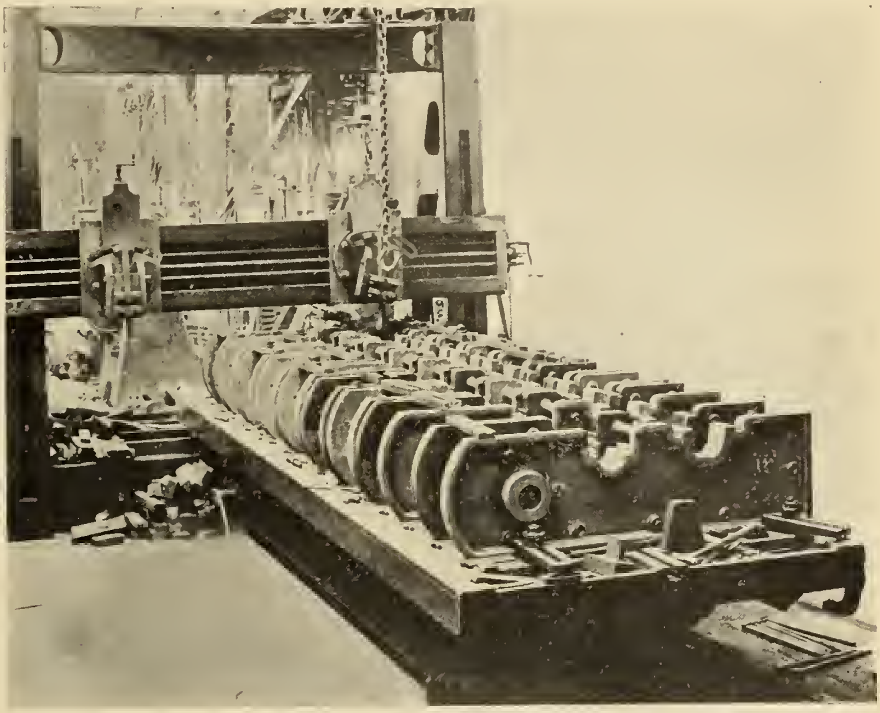
In these days of sharp competition these manufacturing firms, working under peculiar conditions, which have been developed during the last twenty or thirty years, and which have grown from small, insignificant beginnings to concerns, the names of which are known in nearly every household in Canada and also abroad, find themselves at a great disadvantage in their way of shop management and shop methods compared with the manufacturers who make one specialty and can develop their shop practice with the one end in view: To manufacture the different parts of their



1. Finishing Engine Beds of Small Engine

machines in the most economical manner, by the liberal use of jigs, templets and special tools.

These modern methods cannot be entirely adopted by most of our manufacturers, as the demand for a large class



2. Planing Side Plates of Portable Engines.

of machinery is still quite limited or orders for such machinery are often a year or more apart, and to come next to it the shop management has to invent new methods to facilitate the work, cheapen the labor and utilize the existing shop equipment to its best advantage.

A visit to one of these shops recently showed how they took advantage of their machinery and had developed methods of their own in machining castings in small lots.

The first photograph shows the finishing of engine beds of small high-speed engines. The beds come from the foundry and pass through the chipper's hands where all the rough fins, etc., are removed, and the castings thoroughly cleaned from the adhering sand. Six of these beds are then placed on one planer to finish the bottoms. The castings are placed approximately parallel to the planer bed by finding the centre of flange and guide and are then planed. These engines carry a valve rocker arm. Bosses are provided on the bed castings to securely fasten the rocker arm. These bosses are then finished, the castings are then turned around, placed on their planed bottoms and set in line, the finished valve rocker bosses helping the man in setting up the castings at right angles. The tool is run across the centre of the flange to which the cylinder connects, making a mark on either side that is perfectly parallel to the bottom and in the same horizontal plane as the line through the centre of the journals. After finishing the journal faces, the beds go to the horizontal boring mill, where the cylinder flange and guides are finished. Having the bottom of the castings planed the centre of the flange and guide mark, it is an easy matter for the man running the boring mill to centre his bar and cut the guides and flange true.

Adopting this method of handling six beds in one setting has resulted in a saving of over thirty per cent.

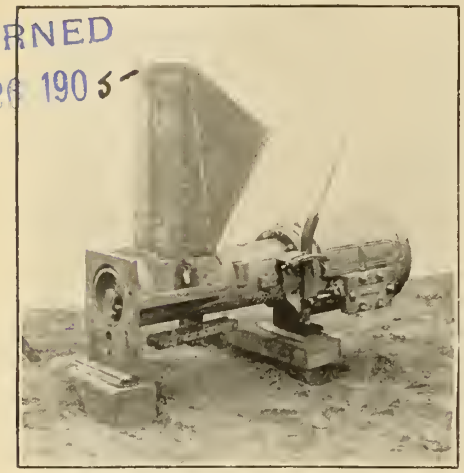
The second photograph is another example of cutting down the actual time for finishing up castings in the same shop. The photo shows side plates of portable or traction engines in which the bearings are set in the side frames. By placing these side plates on the planer as shown in the photograph a saving of over 25 per cent. has resulted.

Besides saving time, this method insures a greater regularity in the finished castings, as it would be an impossibility for this firm to carry templets and gauges for every casting used in the various machines they are manufacturing.

Illustrations as an Advertising Power

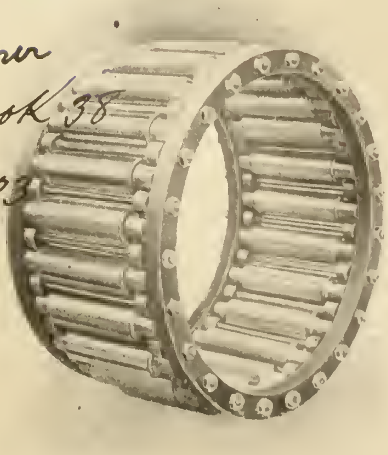
By A. A. Briggs, Advertising Specialist, Toronto.

NEVER before in the history of advertising has the illustrated advertisement occupied such a conspicuous place. This development, occupies to-day. This development, which is especially true of machinery advertising, might be traced to various



sources and attributed to various causes, but undoubtedly the chief source and chief cause is increased belief in the value of illustrations as an advertising power.

Such a development has necessarily been attended with circumstances peculiarly its own, and its various stages marked by divergency of opinions not only as to the wisdom of the forward movement, but as to the actual value of it. Be that as it may, it never could be

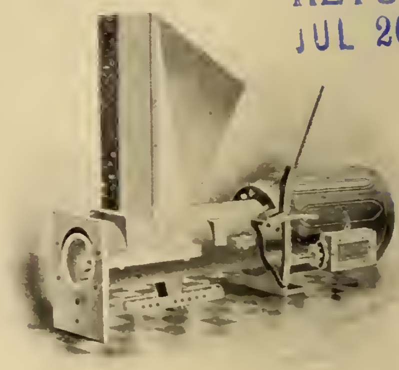


rightfully claimed or denied that the illustration itself brings business. It was rightfully claimed, and is now generally accepted, that the illustration assists in bringing business, and that in the measure of its quality is the measure of its power. Good illustrations, especially in machinery advertising, undoubtedly enforce argument. Poor illustrations, on the other hand, undoubtedly mar argument. And while we cannot directly attach certain results to these facts we can, by viewing a number of cases and weighing a number of conditions, in a measure trace failures and successes.

The illustrations here given are a good sample of what may be attained in the art and what sometimes is attained—the difference before and after "re-touching." If these illustrations emphasize anything, they emphasize this: That as a machinery manufacturer discriminates in the raw material he uses for particular manufactures, so should he discriminate in the illustrations he uses to illustrate these manufactures. To use illustrations not properly re-touched is on a par with using poor material, and worse still—a waste of money. To use illustrations not suitable to the paper on which they are to be printed is just about as bad. Care should be the more rigidly exercised in the selection of illustrations because even a perfect machine cannot be photogrphed "perfectly" in a first process. Clearness of detail being highly essential, mechanical photos require the most retouching. It is obvious that the better the photo the smaller will be the amount of money spent on the engraving. The adaptability of the illustration to the paper upon which it is to be printed is gauged from the photographer's standpoint by screens. These screens, consisting of fine black lines ruled on a sisting of fine black lines ruled on a glass plate, placed in front of the sensitive plate during exposure, form the basis for tone gradation. The lines vary from as few as sixty to the inch to as many as three hundred, and even more, according to the quality of the paper on which the illustration is to be printed.

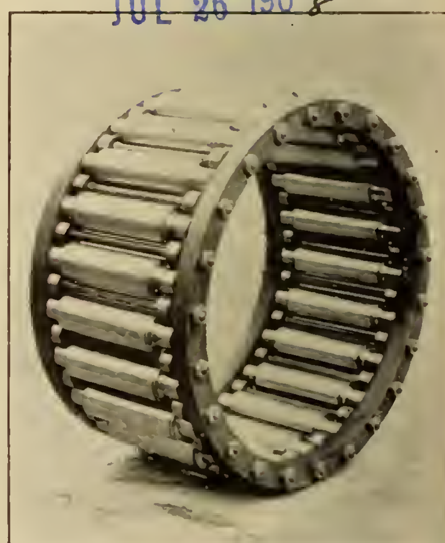
If machinery advertisers recognize the value of employing the best illustrations the next question for them to consider is what to illustrate and how to illustrate it. At this second stage many of the advertisers who fully realize and appreciate good quality in illustrations, illustrate their advertisements inefficaciously—they have the best illustrations but the poorest things are illustrated.

If the policy of procuring the best illustrations in machinery advertising is adopted and the selection shows method as well as judiciousness, the advertiser must next see that his plan is not marred by either insufficient or cramped details. The illustration should be suitable in size to the space, and then the matter should be suitable to the illustration. Some advertisements well illustrated are often spoiled by the



wording. Others, again, are often well written, but the illustration is too large. It is just as important that each one of these considerations should be studied in its relationship to the other, as they both should be studied in their relationship to the whole—the power of the illustration to appeal to the buyer's eye; the power of the matter to appeal to his reason.

The illustrations showing the differ-



ence between illustrations made from original photos and those made by re-touching. We are indebted to Legg Brothers, Toronto, for their courtesy in loaning these cuts, which are some of their work.

ABOUT CATALOGUES

Any Catalogue spoken of on this page will be sent upon request
Kindly mention Canadian Machinery

THE CANADIAN WESTINGHOUSE CO., LIMITED, Hamilton, have issued an exceedingly handsome catalogue on the eve of the completion of the works in Hamilton. The cover consists of a color design contrasting in an effective way the primitive and modern methods of lighting. Besides illustrations and descriptions of electrical apparatus, the catalogue contains a short review of the Westinghouse history, and touches on the reasons for establishing the Canadian company.

Catalogue No. 12, of A. B. Jardine & Co., Hespeler, Ont., is a general catalogue illustrating and describing the several lines manufactured by this firm.

The brass and copper stock of the Waterbury Brass Co., Waterbury, Conn., is brought before users in a neat little booklet of 75 pages.

The McGraw Pub. Co., 114 Liberty street, have issued their June, 1905, catalogue of engineering books.

Catalogue No. 41, of the Newton Machine Tool Works, Philadelphia, U.S.A., describes and illustrates the Newton rotary planing machines.

W. H. Blake Steam Pump Co., Hyde Park, Mass., have issued a bulletin, 9 x 6½ inches, illustrating and describing their surface and jet condensers.

"Air Lift Pumping" is the title of a leaflet sent out by the Ingersoll-Sergeant Drill Co., 26 Cortlandt street, New York, calling attention to their air lift pumps.

The Canada Machinery Co., Limited, Sarnia, Ont., have issued a very neat little booklet containing very handsome illustrations of some of the machine tools made by them.

The 1905 catalogue of the Crescent Machine Co., Leetonia, O., U.S.A., deals with crescent wood-working machinery, particular attention being paidto band saws; 31 pages, 5 x 7 inches.

The Blue Book of Air Compressors is the title of a neat booklet printed in blue, issued by the Ingersoll-Sergeant Drill Co., New York, illustrating and describing their air compressors.

The W. H. Blake Steam Pump Co., of Hyde Park, Mass., have just published an attractive catalogue, No. 25, illustrating the jet and surface condensers manufactured by this company.

Arthur S. Leitch, Bay and York streets, Hamilton, Ont., have issued their stock list of new and second-hand metal and woodworking machinery in neat booklet form; 15 pages, 6 x 3½ inches.

"Air Power" is a monthly periodical published by the Rand Drill Co., 128 Broadway, N.Y. The first number was issued in March, 1905. It is devoted to the consideration of compressed air as a motive power.

The W. G. Leale Co., 119-121 Mission street, San Francisco, Cal., have issued a catalogue, 9 x 4 inches, illustrating and describing a new process of pumping by compressed air, invented by D. W. Starrett.

The 1905 catalogue of the Leeds & Northrop Co., Philadelphia, Pa., of electrical measuring instruments, is very complete, each instrument being described and illustrated in detail. The catalogue contains 110 pages, 6 x 9 inches.

The Ingersoll-Sergeant Drill Co., 26 Cortland street, New York, have published in catalogue form, 9x6 ins., and 31 pages, a well-illustrated description of the central air plant at the quarries of the Cleveland Stone Co., North Amherst, O.

Circular No. 1050, of the Canadian Westinghouse Co., Limited, Hamilton, illustrates and describes type C. polyphase induction motors; circular No. 1068 described and illustrates type S. dynamos and motors, direct current; and circular No. 1104, May 1905, is devoted to portable instruments.

The catalogue of the J. C. Wilson & Co., mechanical engineers, iron and brass founders, Glenora, Ont., describes and illustrates in detail the Little Giant turbine water wheel, besides touching on power transmission machinery manufactured by the firm; contains 88 pages, 5 x 7¼ inches.

The Chicago Pneumatic Tool Co. have just sent out a pamphlet describing their automobile speed recorder, which is the only one yet devised which registers the mileage and at the same time keeps a record of the mileage. Another pamphlet describes different makes of batteries manufactured by this company.

The catalogue of the Martel-Stewart Co., Limited, Montreal, is an elaborate piece of work. The Martel-Stewart Co.'s business being that of signs af all descriptions, they manifest good judgment in abundantly illustrating their catalogue and in using only the best illustrations. The details are clear-cut, forceful and arranged with discretion. The typography throughout is first-class. A copy of this catalogue can be had by mentioning Canadian Machinery.

BOOK REVIEWS.

"CONCRETE-STEEL," by W. Noble, Twelvetree, London, Whittaker & Co., a treatise on the theory and practice on reinforced concrete construction. This is a timely book dealing with the subject under general discussion at the present time. In it the author has dealt with the subject in a definite manner, leading up from concrete and steel as taken separately to the effect of their joint action. The theory of concrete steel is also discussed and the chief types of members employed in construction. The complete volume is a decided addition to the literature on the subject of concrete steel.

"Electric Railways," by Sidney W. Ashe, B.S., and J. D. Keiley, New York: D. Van Nostrand Co., price $2.50 net. A theoretical and practical book on the subject of electric railways that leads the student of it from the first principles of electric engineering as applied to electric railways to the the practical understanding of the equipment and performance of a modern electric railway, dealing as well with the operation of the cars. No other book on the subject has been written that is calculated to cover the subjects in as broad a manner.

"James Watt," by Andrew Carnegie, one of the famous Scott series; Edinburgh and London: Oliphant, Anderson & Ferrier publishers. No better comment can be made on this interesting volume, which has been read with the greatest of interest both in Europe and America, than to quote the author's preface to the book. He says: "When the publshers asked if I would write the life of Watt I declined, stating that my thoughts were upon other matters. This settled the question, as I supposed: but in this I was mistaken. Why shouldn't I write the life of the maker of the steam engine, out of which I made my fortune? Besides, I knew little of the history of the steam engine and of Watt himself, and the surest way to obtain knowledge was to comply with the publishers hghly complimentary request.

"I now know about the steam engine, and have also had revealed to me one of the finest characters that ever graced the earth.

"I am indebted to friends—Messrs. Angus Sinclair and Edward R. Cooper—for editing my notes upon scientific and mechanical points.

"The result is this volume. If the public, in reading, have one tithe of the pleasure I have had in writing it, I shall be amply rewarded."

ENGINEERING NEWS
AND BUSINESS NOTES

SOCIETY OFFICERS.

Canadian Society of Civil Engineers.

Officers for 1905: President, Ernest Marceau, Montreal; treasurer, H. Irwin; secretary, C. H. McLeod Rooms: 877 Dorchester St., Montreal.

Engineers' Club of Toronto.

President, R. F. Tate; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms: King St. W., Toronto.

Canadian Mining Institute.

President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Land, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Toronto Branch A. I. E. E.

Chairman, T. R. Rosebrough; vice-chairman, H. A. Moore; secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Association of Stationary Engineers.

President, Chas. Moseley, Toronto; secretary, A. M. Wickens, Toronto.

Ontario Association of Stationary Engineers.

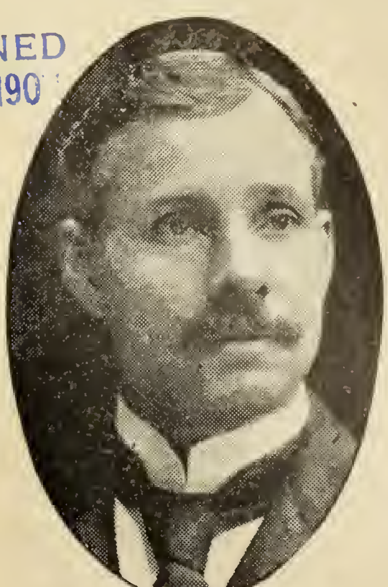
President, F. W. Donaldson; registrar, J. G. Bain, 113 Yorkville avenue, Toronto.

Engineers' Society S. P. S.

President, J. P. Charlebois; recording secretary, E. C. Ash; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriss.

Ontario Power Commission.

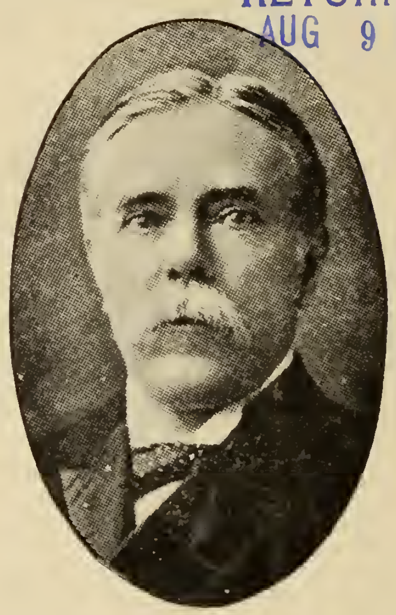
THE Ontario Government made a definite move in the right direction when it decided to appoint the electric power commission to inquire into the question of the water-power possibilities of the Province of Ontario. The commission includes the Hon. Adam Beck, representing London, who has made a careful study of the



Geo. Pattinson, M.P.P.

subject; Mr. George Pattison, M.P.P. for South Waterloo, and one of our manufacturers, and Mr. P. W. Ellis, a successful manufacturer and public-spirited business man of Toronto. The investigation that is about to be carried on is of the most important nature and should have considerable effect on the progress of manufacture within the province.

It is hinted that the Government even propose to assume control of the existing franchises at Niagara and place all water-powers under state control. This would be a decided innovation on the part of a government, but, if properly executed, would have the effect of supplying power to manufacturers at a much cheaper rate and thus advancing the interests of the country.

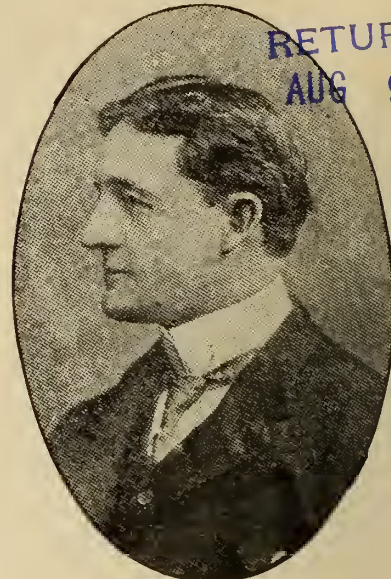


P. W. Ellis.

Canadian Electrical Association Convention.

From the reading of the first report at the opening session of the Canadian Electrical Association Convention on Wednesday, June 21, until the final motion at the business meeting on Friday afternoon, the entire proceedings were marked by the greatest interest on the part of those who attended the convention. An outline of the proceedings was given in the June issue of this paper. The papers read were followed by discussions bringing out the many points more fully, the papers themselves being of a high order. The questions and answers were printed in a neat booklet and distributed to the members.

Although no banquet was held, the social part of the convention was not eliminated. Through the courtesy of Allis-Chalmers-Bullock, Limited, the members were conveyed from the Windsor Hotel by special cars to the company's works at Rockfield, where an elaborate luncheon was given, after which a visit was made to the works



Hon. Adam Beck.

followed by tours to the different substations through the city. The same evening a smoker was held at Electric Park, Back River, where special cars conveyed the party. A concert was held and light refreshments served.

All the delegates to the convention are indebted to the Montreal Street Railway for a generous book of car tickets, enabling them to ride free during the entire week of the convention. The Canadian Society of Civil Engineers placed their handsome quarters at the disposal of the association for the convention meetings.

The officers elected for the coming year are: A. A. Wright, M.P., Renfrew, Ont., president; R. G. Black, superintendent of Toronto Electric Light Co., vice-president; John Murphy, Ottawa, second vice-president. C. H. Mortimer was unanimously re-elected secretary-treasurer. The executive committee for the following year are: K. B. Thornton, superintendent lines of the Montreal Light, Heat and Power Co.; A. A. Dion, superintendent Ottawa Electric Co.; R. B. Reesor, manager Electric Light and Power Co., Lindsay, Ont.; Chas. B Hunt, manager London Electric Co., London; J. A. Kammerer, director of the Cataract Power Co.; J. J. Wright, manager Toronto Electric Light Co.; W. Williams, manager Sarnia Gas and Electric Co.; Lewis Burran, Quebec Railway Light and Power Co.; H. O. Fisk, Peterboro Light and Power Co.; J. W. Purcell, Hiram Walker & Sons, Walkerville.

It was decided to hold the next annual convention of the association at Niagara Falls.

CANADIAN

MACHINERY

AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

The MacLean Publishing Co. Limited

President: JOHN BAYNE MACLEAN, Montreal
Vice-President: W. L. EDMONDS, Toronto.
Managing Director: D. O. McKINNON, Montreal
Managing Editor: F. S. KEITH, B.Sc., Montreal.

Also Publishers of HARDWARE AND METAL and other trade newspapers. Circulates everywhere in Canada, also in Great Britain, United States, West Indies, South Africa and Australia.

OFFICES:

CANADA

MONTREAL - - - - 232 McGill Street, Telephone Main 1255
TORONTO - - - - 10 Front Street East, Telephone Main 2701
WINNIPEG - - - 511 Union Bank Bldg. Telephone 3726, F. R. Munro
BRITISH COLUMBIA - - - - - Vancouver, Geo. S. B. Perry

GREAT BRITAIN

LONDON - - - - 88 Fleet Street, E.C. Telephone Central 12960, J. Meredith McKim
MANCHESTER - - - - 92 Market Street, H. S. Ashburner
BIRMINGHAM - - - 26 Braithewaite Road, James J. Blood

FRANCE

PARIS - Agences Havas, 8 Place de la Bourse

SWITZERLAND

ZURICH - - - - - - Louis Wolf, Orell Fussli & Co.

SUBSCRIPTION $1.00 PER YEAR.

New Advertisers in this Number:

Bertram, John, & Sons, Dundas, Ont.
Butler, Wm., Hamilton, Ont.
Clark-Demill Co., Hespeler, Ont.
Canada Machinery Co., Sarnia, Ont.
Canadian Drawn Steel Co., Hamilton, Ont.
Canadian White Co., Montreal.
Jardine, A. B., & Co., Hespeler, Ont.
Krug & Crosby, Hamilton, Ont.
Taylor & McKenzie, Guelph, Ont.

THIS MONTH'S COVER.

SINCE the first appearance of Canadian Machinery the colored cover designs have been the subject of many favorable comments by those who had a due appreciation of the artistic. This month's design is the reproduction of a photograph showing actual work in a Canadian machine shop. The view shows the machining of one of the cast-iron sections, being placed leading from the intake to the turbine tube at the wheel-pit of the Electrical Development Company at Niagara These castings were made and machined by the Canada Foundry Co., Limited, at whose works the photograph was taken.

The casting shown is but a quarter of a section, which weighs twenty tons. It is 7 feet 3 inches high, three inches thick, and of irregular shape, the complete section being oblong at one end and elliptical at the other. Dimensions of the section are: Bottom flange 14 feet 3 inches by 13 feet 5 1-8 inches, and top flange, 15 feet 9 inches by 14 feet 7 5-8 inches.

BUILD UP SMALL INDUSTRIES.

PROSPERITY has been so general in this country of late that the very air seems to breathe of it and people look for it as a matter of course. At the present time the grassy meadows, the fields of growing grain, the loaded orchards and the contented cattle proclaim the fact, while the activity in the warehouse, the busy mill and workshop, running night and day in many instances, tell more plainly than many written chapters the prosperous state of affairs. In spite of this there is many an older settled town and village in Canada at a standstill, when such need not be. The large cities are growing larger, the west and north are being settled in a satisfactory manner and yet a large number of the smaller centres look on and wonder why they do not share in the general advance. They cannot imagine why things do not come their way.

The reason is obvious. They are asleep. Like the ancient town of legendary fame, they have sat down to rest, unable to realize that they have within themselves the potential energy—brains and capital—that rightly directed would double the municipality's population in a few years. While this is not a general state of affairs, the places that should feel guilty on the subject are not few. There isn't a town in Canada included in this category but has men of means, whose capital is unproductive—unproductive beyond the interest of a savings' bank or a loan or mortgage. Such capital placed toward starting a number of small industries of the right sort in the community would act as a magician's wand and change the whole order of things within half a generation.

In most cases towns owe their present size to a few men of pluck and enterprise, who, starting in a small way, have built up manufacturing industries that have been the mainstay of the people.

Since this has been, what greater results might be expected to-day where conditions for manufacturing are so much better than formerly. Because some places have had their fingers burned bonusing something that has not been successful, the moneyed men therein twist a few extra coils around the necks of their money bags and shake their heads at the thought of promoting an industry. Bonusing questionable industries has been an evil in the past and must continue so. A concern started with the sounding of trumpets and the clashing of cymbals by outside individuals with a town's money may succeed all right—many times it hasn't—but let the same industry be started with private capital, the men interested sitting at the directors' board, and there is little danger of the outcome.

Half a dozen smaller concerns covering a variety of manufacture give more stability to a place than a single plant six times as large as the average of the others. If the towns that have not grown appreciably within the past few years would give the matter a thought, and if the men who have the stock in trade to promote industry are public-spirited enough to do so, the way to bring their native or adopted place forward should be clear before them. A number of industries started either under one or separate management and rightly looked after can hardly fail to bring about the desired result.

MORE HIGH-SPEED STEELS.

ALTHOUGH recent progress in the manufacture of high-speed steels has been little short of phenomenal, the end is apparently not yet reached. A correspondent from Sheffield informs us of the production of two new steels that have just been brought out in that city. It is not surprising to learn that these have had their origin there, since the whole history of the steel industry were marked by discovery and invention emanating therefrom. To eliminate the work and labor of the chemists and metallurgists of Sheffield would be to leave the world much poorer in commercial industry.

One of these steels is an intermediate

quality of rapid-cutting tool steel. Its wearing and cutting capacities, ranging between that of the old of original self-hardening and the best of the most modern make. The other is water hardening, capable of maintaining a keen cutting edge longer than anything of the kind hitherto produced. If these steels can fulfil the specifications with which they are credited, there is already a place awaiting them in the manufacturing world. At present not even 5 per cent. of all the tool machinery in use is designed for actual high-speed cutting. However, present-day necessities are more exacting than they were formerly, and the general body of manufacturers from the smallest to the largest have become fascinated with the idea held out to them of making more of their existing machinery than is possible under present circumstances. In the case of the former steel it can be produced at a low cost and fulfilling all the requirements of a rapid-cutting tool steel, it would be of a kind calculated to meet the needs of a large proportion of machinery owners. All that is required to harden it is to heat it to a bright red, not beyond the "critical point," and allow it to cool naturally in the air without the use of an air plant. To anneal it for easy machining it is heated to a cherry red and the heat let sink while held over the fire to a very dark red and then plunged into water. Repeated hardening and softening does not affect its wearing qualities. In a test on a railroad tire, a drill made of this steel drilled 49 holes 15-32 inches in diameter, 17-18 inches deep, at an average speed of 25 seconds, after which the drill was in good condition.

The other steel for cutting purposes is a sort of a paradox, for, notwithstanding the fact that it is hard enough to cut glass, it will bend easily. Glass hardness has usually meant brittleness, but they seem to have been separated in this case. A knife whetted to razor edge was made to cut through knots of red wood, after which the edge was sufficiently keen for shaving. So far, neither of these steels have come to Canada, but if they are all that is said of them they will, no doubt, become a factor in future production.

NO MACHINERY TAX.

When it was proposed recently to levy a tax on machinery used for manufacturing purposes in the City of Toronto, representatives of the Canadian Manufacturers' Association waited upon the city council asking them to reconsider the matter. The answer given at the time led the manufacturers to believe that the tax would not be revoked and that they would have to pay some $26,000 into the city treasury for the machinery they were using to operate their respective plants. Other pressure was probably brought to bear on the city council and the shortsightedness of their policy made apparent to them. The Board of Control recently authorized the tax collectors to the effect that this was not to be collected this year. Had the city collected the tax it would probably have lost many times the amount by frightening intending manufacturers from coming to the city.

LIGHTING MACHINE SHOPS.

The importance of having a machine shop well lighted is not as generally recognized as one would naturally think. A mechanic can work much more quickly in a well-lighted than in a poorly-lighted shop, but in spite of this many a shop is poorly lighted. To light a shop well with natural light is not always feasible because of the construction of the building. However, artificial lighting is under control, and in a shop where night work is being carried on it is poor economy to install anything but good lighting fixtures. This will be completely realized by any mechanic who has set up large work on a planer or similar machine with an eight candle-power incandescent electric light. If the light is hung close enough to the work to give good light it is always in the way, and besides the good light is confined to a small space. On the other hand, if the light is hung high enough to be out of the way its rays scarcely reach the work and it is utterly impossible to make out distinctly the lines on the table of the machine. For ordinary lathe work such a light is suitable, although a greater candle-power would probably pay better in the long run. In the lathe the position of the work with regard to the bed does not change, nor does the tool move through any great distance in a short time. Thus the light can be arranged to shed its rays over the desired space, and its position need not be changed.

If the superintendent of the shop, where the conditions are as described (for there are such shops), would consider the lighting question, he would surely come to the conclusion that the loss of time and the chances for inaccuracy occasioned by poor lighting would warrant the extra outlay for better system.

WIRELESS IN CANADA.

Since our last issue, when an editorial reference was made to a legal decision given in the United States, in which two wireless telegraph companies were concerned, we have received communications from the Canadian branches of both companies. In one case exception was taken to what had been stated, and in the other what we had published was confirmed. Did space permit we would be pleased to publish the entire correspondence bearing on the question.

There is no doubt that the original verdict was favorable to the Marconi Co., but on the application of counsel for the American De Forest Wireless Telegraph Co. the injunction against them on the ground of infringement was suspended. In this connection we are informed by the Dominion De Forest Co. that there is no patent in Canada covering the case in issue in the United States; therefore the dispute does not extend to this country.

We have no desire to be partial in any way and believe that both systems possess distinctive merits. Another company, employing the Fessenden system, has recently commenced in Canada, and there is probably room for all three. That competition is the life of trade should be just as true in the case of wireless telegraphy as in any retail business, and we trust that such competition may exist. Monopolies in general are detrimental to progress. Every one knows what has been the result of a monopoly in the telephone business, and we would be sorry indeed should any corresponding circumstances develop in connection with wireless telegraphy.

SOME QUESTIONS OF IMPORTANCE FROM OUR VIEWPOINT

By the Publisher.

CONGRATULATION OR CRITICISM.

MANY friends have seen fit, during the last month or two, to express in kindly terms favorable opinion of the work attempted and the results already accomplished by Canadian Machinery. We need not say that we have appreciated every kind word uttered, yet we are not satisfied ourselves.

We believe the machinery trade of Canada should be represented by a paper that is the equal of the best, that contains as much practical information as any machinery paper in the world. We believe we are making progress to that end, but we will never be content till we reach that ideal.

We are conscious that the paper deserves criticism: we therefore realize and appreciate the courtesy of those friends who remember that papers, like businesses, are not made in a day or a month, and who charitably take note of what has been good rather than what has been faulty.

Nevertheless, we welcome criticism, especially where it is given frankly and in detail. A realization of one's errors is essential to progress. We appreciate criticism, and would encourage discussion of any or every article in the paper. When you criticise get down to detail, prove your point, and you will probably give valuable information to many readers.

THE SUBSCRIBERS WE SEEK.

"My dollar is as good as the next man's," said a subscriber to a subscription agent one day.

And while he spoke the truth, he may not have realized that we would rather have one subscription from some men than one each from half-a-dozen other men.

The subscription list of every technical paper could easily be divided into two classes—the readers who desire amusement, and those who seek instruction.

It is for the man who seeks to widen his viewpoint, to deepen his knowledge, that the best endeavor of our editorial staff are put forth. Such a man not only arouses our respect, but he is an effective factor in the building up of the paper, of making it serve its purpose in the world.

He is not satisfied to scan the reading columns; he takes time to absorb any new ideas or methods. Then he carefully goes through the advertising columns to see if there is anything new for him there, if any of the advertisers have a message for him.

Even then he is not content, but frequently he writes to advertisers for more detailed information about the lines they have advertised. And so, as they are eager to send him such information, he is able to keep in touch with progress in his chosen profession.

His future is assured. He is destined to be, in any case, a foreman or superintendent, and possibly a partner or sole proprietor. The knowledge he is now acquiring will then be of utmost importance to him, as he will then buy his own tools and put his own ideas into practice.

One subscriber of this type is worth six who merely seek amusement. A vital necessity to any paper's upbuilding is a familiar relationship between advertiser and reader.

Without advertising the price of subscription would necessarily be twice doubled. At the same time, without advertising, the value of the paper to the reader would be much decreased.

Without readers who examine and who are influenced by advertising, the value of the paper to the advertiser would be practically nil.

So we render homage to the man who seeks information and who carefully examines the advertising columns to that purpose.

TEN YEARS FROM NOW.

What are you going to be ten years from now?

To-day you have a shop of your own and are doing a fairly nice jobbing and repair business as a machinist. So is your competitor in the next block.

To-morrow you may be doing the same, while he may have started to build the foundation of a manufacturing business.

Ten years from now you may still be doing a repair business with your trade increased from 20 to 50 per cent., while your neighbor may be recognized as one of the best tool builders in Canada.

Are you laying a foundation for bigger things, or are you leaving that to your neighbor?

On another page is an article, "What Three Young Firms are Doing." Read it. These firms are to-day laying a foundation which, if built upon for ten years, should lead to large things.

What will ten years mean to you? Why not make some standard line? Get a reputation for merit in your output. Seek to grow along sound and legitimate lines.

Canada is growing; the use of machinery in this country is increasing at a remarkable rate; patent rights on the most modern tools can easily be secured. If you would get your share of the "growing time" make some staple line and make it so well that buyers will insist on having yours

CANADIAN INDUSTRIAL PROGRESS

Have you realized the exceptional industrial expansion in Canada at present. Take a careful glance through the last four or five pages of reading matter in this issue.

Canada is growing to-day as she never grew before. Moreover, this growth will be kept up for many years. Therefore it is the firm that wins reputation and connection in Canada to-day that is bound to win the golden harvest in the years to come.

Now is the time to advertise. Canadian Machinery is already recognized as the proper medium by which to reach the machinery and power users of Canada.

A LONG STEP FORWARD.

We would like you to turn to page 277 to the list of new advertisers in this issue. This will tell you something we want you to know, and will tell it better than any words of ours could.

We have "made good."

And, let us say here, lest it be not said, that there are no free advertisements in Canadian Machinery. When you see an advertisement in this paper you can depend that the publishers have asked for, and have secured, a legitimate "order" for certain space from the advertiser.

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THE BUYERS' GUIDE.

Do you use the buyers' guide as much as you might? Do you realize how much it would simplify your buying at times?

Look through the index in this number; examine it in detail; you will discover that some firms you know well make some line you never thought they made or sold.

Next month we will have a vest pocket edition for our subscribers. We trust they will find it of great service.

If, by the way, any of our advertisers read this announcement we would suggest to them that they make a note of our purpose, and that they take measures to see that their name appears every place it is entitled to appear. We desire to make this index as comprehensive and as thorough as possible, and we depend on the co-operation of our advertisers to that end.

Practical Questions and Answers

At the Canadian Electrical Association convention at Montreal many of the questions asked and answered in the question box were of a most practical kind. There were eighty-three in all, so that it is impossible to give more than a few of the entire number on this page. Although in nearly all cases several answers were given to the questions asked, only one is reproduced here.

* * *

Water Wheel Practice.

Ques. Is it good engineering to place three or four water wheels on one horizontal shaft to get speed under low head? What are the objections, if any?

Ans. There would be several good features about a layout of four turbines on one shaft. In case of insufficient water supply, two could be disconnected, giving much higher efficiency in carrying a small load, with no end-thrust. In case of one turbine becoming disabled, a smaller proportion of total power would be deducted (if end-thrust could be taken care of during emergency run); or shafting might be arranged so that either pair could run the unit alone, thus giving half power with no end-thrust. Would never advise placing three or any odd number of turbines on same shaft, if possible to put on wheels in one or more pairs. An unbalanced end-thrust is always liable to give trouble.—G. Hartman, Quebec.

* * *

Bridge Wall Arch in Boiler.

Ques. Is there any way of building a bridge wall arch under the first seam in a boiler that will not interfere with combustion or lessen the capacity of the boiler?

Ans. The old style circular arch is going out of use and the bridge-wall even across the top, and with a gradual slope from the base to the top, the top being slightly sloping towards the back end of the boiler, leaving not less than 16 inches between top of bridge and bottom of boiler, will not interfere with combustion and economy.—G. A. Shackleton, Kamloops.

* * *

Water in Steam Turbine.

Ques. (a) What will happen to a steam turbine if water comes over from a priming boiler? (b) How would it affect the speed of the engine?

Ans. The steam consumption of a turbine at any specified load depends on the steam pressure, superheat, size and style of turbine. For complete answer to this question refer to a paper on steam turbines by H. M. Jaquays, read in 1904 before the Canadian Society of Civil Engineers.—L. A. Herdt, Montreal.

* * *

Starting Torque.

Ques. What is understood by the "starting torque" of a motor?

Ans. By the starting torque is meant the force which the motor will exert at the rim of its pulley at starting. This force is usually expressed in pounds pull at one foot radius; thus if the radius of the pulley is less than 12 inches, the pounds effort which would be exerted at its rim would be directly proportional to the ratio of its radius to 12 inches. A simple definition of starting torque might be expressed as the pull in pounds which the motor will exert upon a rope fastened to the rim of the pulley and secured to a stationary body.—R. T. MacKeen, Toronto.

* * *

Right to Move Wires.

Ques. Has a contractor a legal right to move a tall building down a street where wires are strung and order the lighting company to take their wires down, or to pull them down if the company refuses to comply?

Ans. It depends on the franchise granted the lighting company. It may be assumed that both the lighting company and the house mover have a right to use a street, but neither of them an exclusive right. It should be easily a matter of arrangement, and if the lighting company moves its wires to accommodate the house mover, the latter should bear the expense of the removal, provided that it is a reasonable one. —J. J. Wright, Toronto.

* * *

Cleaning Wire.

Ques. What is the best method of cleaning joints on a transmission line preparatory to soldering them? The line is a bare one and has been up for some years, but the joints were never soldered.

Ans. Under the conditions mentioned, the only proper way seems to be to cut out joints and put in new ones, or put in jumpers soldered on either side of the old joint. Cleaning with zinc and sulphuric acid is effective, but the corrosion due to the acid not evaporated by the solder remaining in the joint makes it bad.—J. F. H. Wyse, Toronto.

* * *

Solid Wire vs. Hemp Cord.

Ques. Why is a transmission cable made of six wires over a hemp centre preferred by some engineers to all-copper cable?

Ans. The use of a copper wire cable for a copper cable is very objectionable, due to the fact that the moment any strain comes on the cable this strain is assumed almost entirely by the copper wire centre, with the result that it is elongated to a point where the cross-section and strength are materially reduced or, in some cases, until rupture occurs. This is due to the fact that the outer conductors of the cable are wound spirally, and hence possess in a measure the properties of a spring. The result is that it can be elongated very much more upon the application of tension than is possible with the solid conductor. A hemp centre is more elastic, and hence is free from the objections of the solid wire centre, and apart from the question of conductivity furnishes a substantial core upon which to wind the cable. It is also of considerable strength, and doubtless adds materially to the total strength of the cable. In this case, however, the whole tension is practically taken by the copper conductors.—R. T. MacKeen, Toronto.

* * *

Compressed Air for Cleaning.

Ques. (a) Is it advisable to use compressed air to clean dynamos, etc., in a central station? (b) At what pressure? (c) Has the suction method used in house cleaning ever been tried on dynamos? (d) Would it not prevent raising dust through the air to fall later on the dynamos?

Ans. (a) Yes, in every instance when possible. (b) At 50 lbs. per square inch. (c) Not to my knowledge. (d) An excellent idea, and would prevent the dust falling back on machines, but would not reach the distances in small places, for instance between the armature and field coils or pole pieces, like an air blast.—J. F. H. Wyse, Toronto.

* * *

Running Alternators.

Ques. Is it practicable to run two single-phase alternators of same make and size (125 cycles, belt-driven from same shaft), synchronously or in parallel?

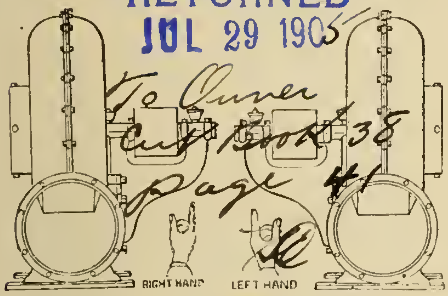
Ans. It is practicable but difficult to run two single-phase alternators in parallel if belt-driven from same shaft. The pulleys must have the same dimensions. A very minute difference in the diameter of the pulleys will be sufficient to take the two machines out of phase unless the design of the alternators are such that they synchronize with a power sufficient to make one belt slip.—L. A. Herdt, Montreal

Power and Transmission

Steam *Gas* *Electricity* *Compressed Air* *Water*

BLOWING AND EXHAUST FANS.

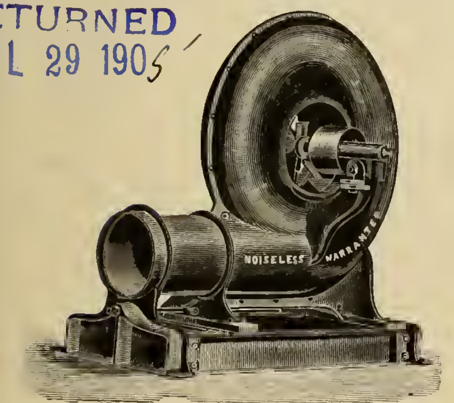
SHELDON & SHELDON, of Galt, Ontario, manufacture a large variety of blowing and exhaust fans, of some of which illustrations are given. The blowers have an air inlet on



Sheldon & Sheldon.

Right Hand Fan. Left Hand Fan.

each side of the fan and are furnished with a bearing on each side of the casing, being used advantageously for such purposes as forge fires, gas irons, brazing forges, re-heating, puddling and many other kinds of furnaces. Exhaust fans have only one inlet which is entirely unobstructed, the two bearings being placed on the opposite side of the casing, which is closed. Exhausters are used when it is necessary to connect pipe to the inlets for general exhausting purposes. These fans are more commonly used for removing the dust from emery, buffing and sand wheels, stone and ore crushers, for taking away leather cuttings from shoe finishing machines, and for exhausting



No. 5 Blower, Bottom Discharge.

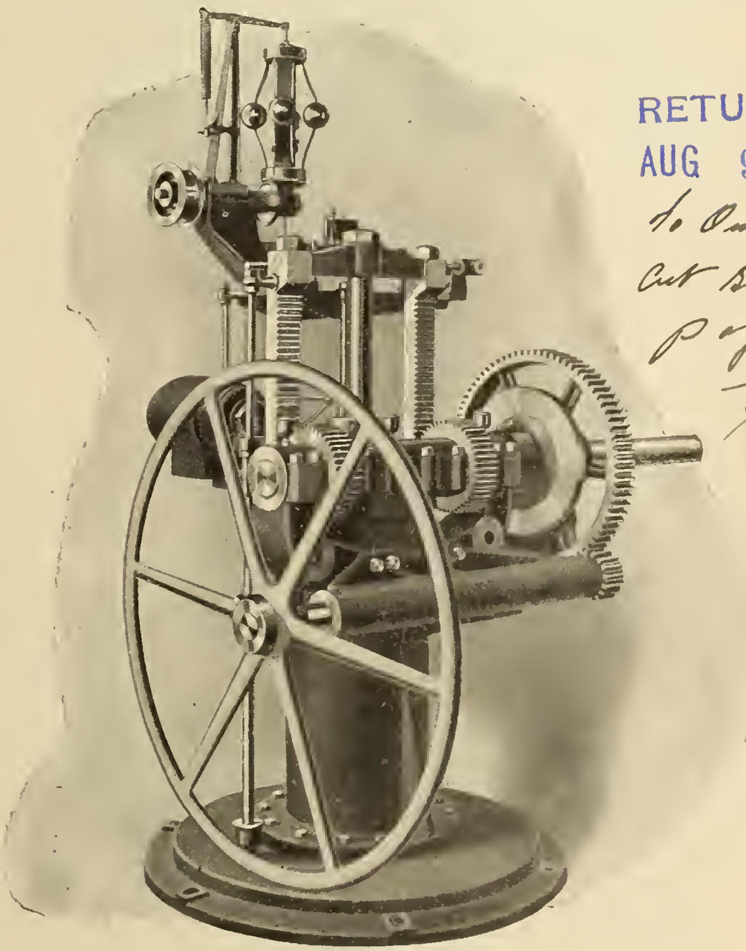
smoke fumes and hot air from the rooms. They can also be used for cleaning and separating grain, and for transporting wool, cotton and other textile materials.

These fans are made either right or left hand, as shown in the diagram. The hand being defined by the relative position of the pulley.

A bottom discharge blower is shown. These are used as connected with cupola furnaces and forges, or for producing mechanical draft for steam boilers. The shell is of cast iron in two pieces; the shaft of steel and runs in phosphor bronze boxes, which are provided with an oil well.

LOMBARD GOVERNOR.

MODERN tendency towards efficiency in the application of natural and human forces is strikingly shown by the continual increase in size of prime movers in steam and water-power plants. In consequence new conditions are arising and it is necessary to modify continually the accessory apparatus in order to get the best results. Every engineer is familiar with the radical changes which have been made in the electrical generating and distributing mechanism which now form such an important part of all large power plants, but it has not been brought so forcibly to the attention of the public that just as great improvements have been made in the control apparatus for the prime movers. Especially is this true in



Lombard Governor.

water-power stations, where speed control of the turbines is at best an exceedingly difficult problem.

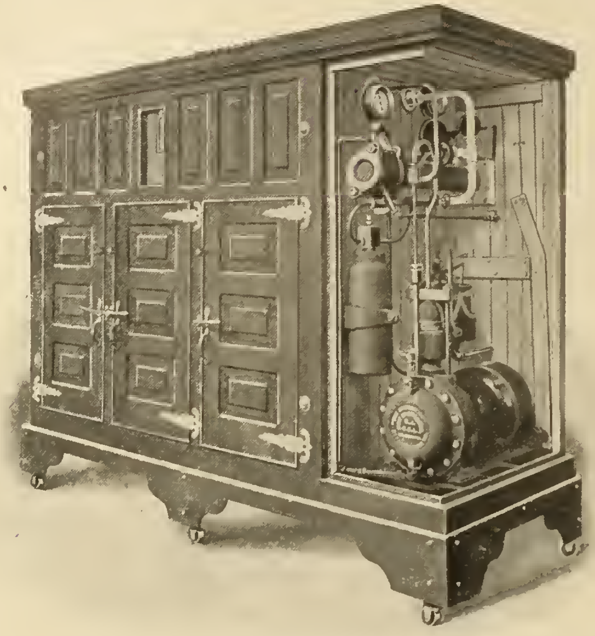
During the last five years the average size of turbine units in new installations has doubled, while the requirements in speed control have become much more severe. Consequently governing apparatus which was adequate a few years ago is no longer sufficient for all purposes.

As will be seen in the engraving the construction is simple and massive. One

large casting forms both the main cylinder and the bearings for the terminal shaft. The base forms the lower cylinder head. The upper cylinder head is integral with the cylinder. By this form of construction maximum strength with the least weight of metal is obtained, while the possibility of joints loosening under the terific strains is entirely eliminated. The straight cylinder construction with piston motion along the axis is retained, for the obvious economy of metal and symmetrical distribution of strains which has been shown by long experience to be far superior to the revolving piston type of machine, such as is used in the multitude of rotary engines filling patent office records, but not finding practical application.

The linear motion of the piston is transformed in the simplest manner by racks and pinions to rotary motion at the terminal shaft. In order to reduce the vertical height of the governor, and also to transmit the enormous force at the piston to the rotating shaft in the most efficient manner, double racks and pinions are used, the racks being connected to an equalizing yoke. The location of the racks is alongside the cylinder instead of beyond it as has been the custom heretofore.

The steel terminal shaft is 2 15-16 in. in diameter and is supported by bearings both sides of the pinions. The total length of bearing of this shaft is 26 inches. The releasing clutch mechanism is of the Lombard governor design properly proportioned for the power of the machine. All keyways are extra wide. The terminal shaft portions are not only keyed, but also shrunk on at a high temperature. The main piston rod gland cap is cup shaped so as to prevent leakage over the machine. The usual form of hand wheel is employed. This is out of gear when the governor is in regular operation.



Refrigerating Machine.

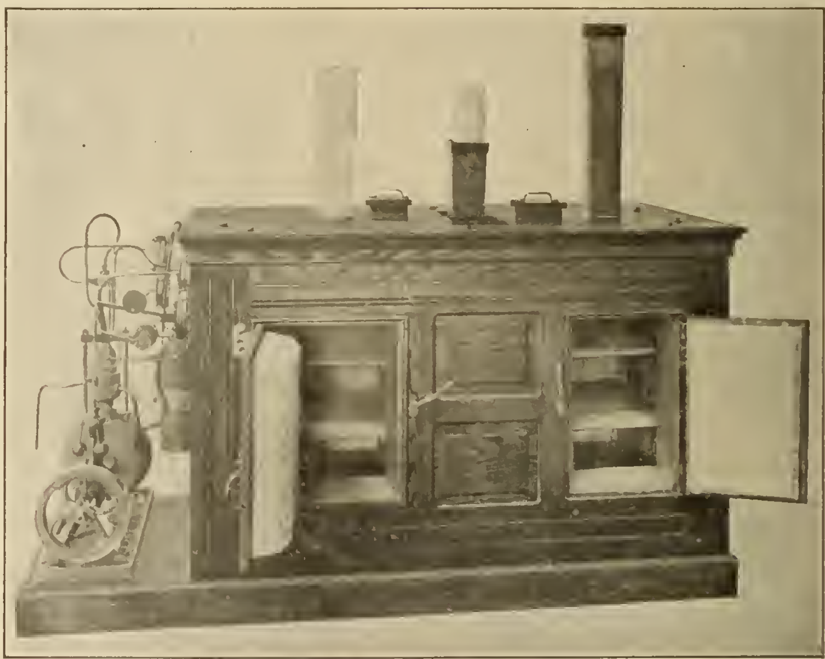
The working fluid for this governor is a special oil kept under pressure in a vertical drawn steel tank. Oil is forced into this tank by a powerful pump, which is part of the equipment of the governor.

The special novel feature about the type N governor is the relaying valve mechanism. In our earlier types of governors, an ingenious mechanical relaying device was used to multiply the comparatively small force and movement of the centrifugal balls sufficiently to control accurately the main valve for the hydraulic cylinder. This mechanism, which was perfectly satisfactory, consisted of a combination of an auxiliary valve, a small hydraulic cylinder with two outside racks and a floating gear. As the size of governors increased, the old style relaying mechanism proved rather cumbersome, occupying too much valuable space and complicating the remainder of the machine to an undesirable extent.

This new relaying device is not only entirely novel, as is shown by the broad patents granted in the United States and the principal foreign countries, but has also given in service considerably better results than have ever been obtained before by any other mechanism.

ICE MAKING AND REFRIGERATION

At this time of the year, when people in this country are suffering more or less from the heat, an account of an ice-making machine that is portable and that may be adapted to domestc use should be of interest. Ice gathered from rivers and bays is not always of the purest, and epidemics have been known to have their origin in an impure ice supply. The illustrations herewith given show a combined ice-making and refrigerating machine, manufactured by the Brunswick Refrigerating Co., New Brunswick, New Jersey. In this machine it is recommended to boil six or



Ice Making and Refrigerating Machine.

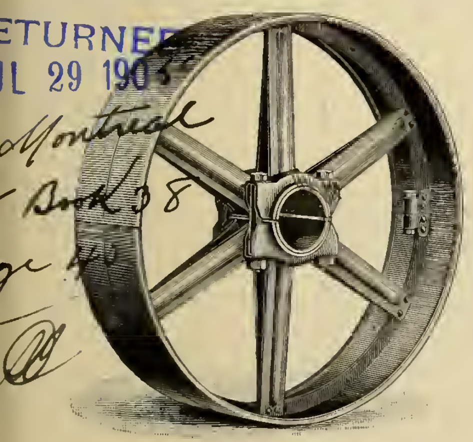
eight quarts of water for ten minutes, allowing it to cool under cover. The ice can connected with the machine is then filled and placed in the receptacle in the refrigerator box, and in ten hours there will be ten pounds of sterilized, hygenic ice.

The machine, consisting of a complete refrigerating plant on a small scale, has a capacity equal to the melting or the use of 200 lbs. of ice per day. It works automatically, and the refrigerating apparatus is installed on the same base as the refrgerator.

THE AMERICAN PULLEY.

A PULLEY is an important factor in every shop. Safety lightness and the proper transmission of power are cardinal virtues in a perfect pulley. The old, lumbering, weighty, ill fitting, keyed, cast-iron pulley is rapidly being replaced with the American All Wrought Steel Split Pulley.

The American pulley is the product of



The American Pulley.

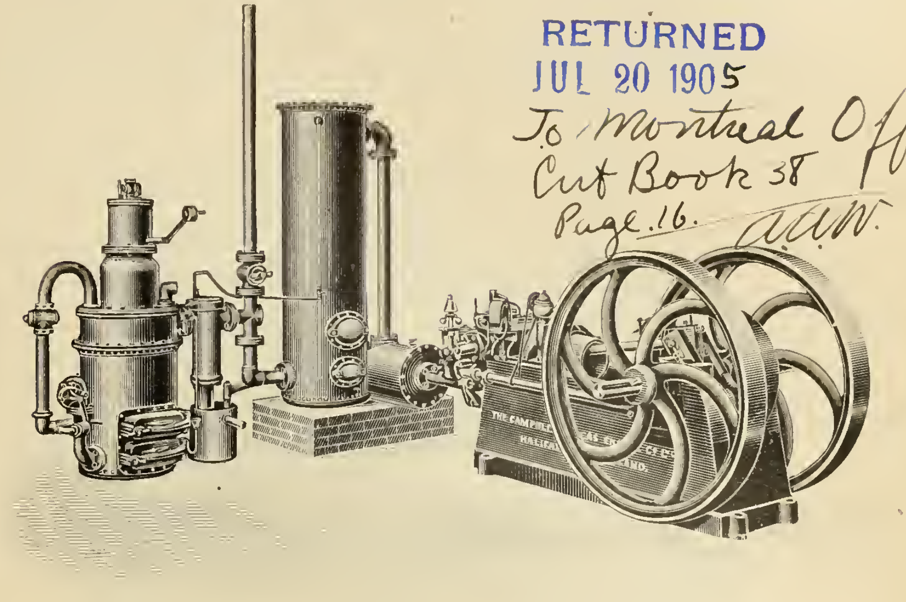
years of experience, and the plant in Philadelphia represents an outlay of over a million dollars. The result, however, has justified the time and money spent, as this pulley to-day is being installed in large plants, not only in English, American and Canadian centres, but is largely in use on the Continent of Europe, South Africa, Australia, and New Zealand.

It is made of all wrought mild steel. The parts are struck up in dies and then assembled. It weighs, size for size, about one-half as much as a cast-iron pulley. Its lighter weight saves a large expenditure of power in propulsion and adds to the life of the shaft and bearings. It requires no keying, as by means of its perfectly adjusting metal bushings it grips the shaft immovably. It can be applied to the shaft without stripping the shaft. This is an important feature, as every mill or shop owner knows. It does not shrink or swell or warp or burn.

Users of this pulley maintain that the little groove on the face where the two halves of the face come together permits the escape of air from under the belt, assisting in this way the traction of the belt on the face of the pulley.

The mechanical construction of the pulley admits of a light rim of one-ply made exceedingly stiff by interior flanges to which the arms are attached and by heavy rolled beads on the edges of the face. Pulleys with rims of two thicknesses of metal are apt to be thrown out of service by the wearing of the outer ply. The arms are flat with their narrow edges cutting the atmosphere, and they converge from near the extremities of the hub to the central flange of the rim so as to make an "A" frame of great strength. The pulley is protected by over thirty patents covering the principal points of its construction.

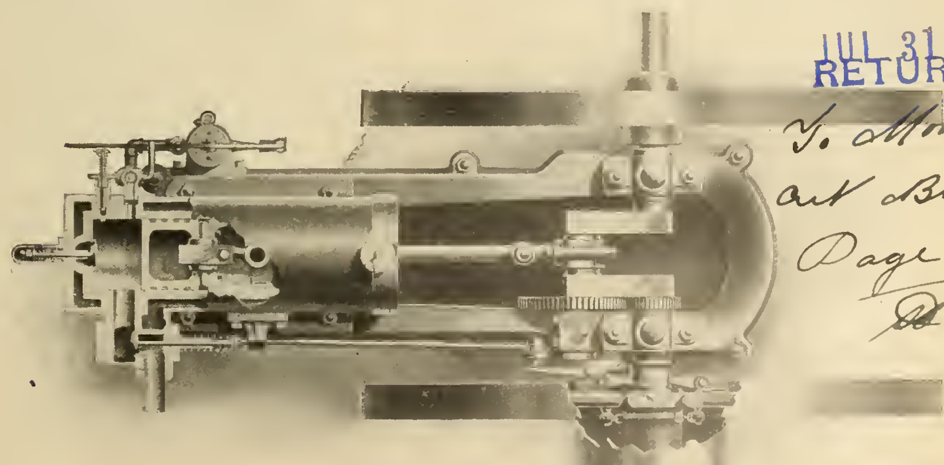
Canadians have not been slow to appreciate the advantages of a pulley of this kind, and they are found in many of the principal shops that have been equipped of late years. A complete stock of all sizes is carried in Canada at the warerooms of Williams & Wilson, 320-326 St. James street, Montreal.



Campbell Gas Producer Plant.

SUCTION GAS PLANTS.

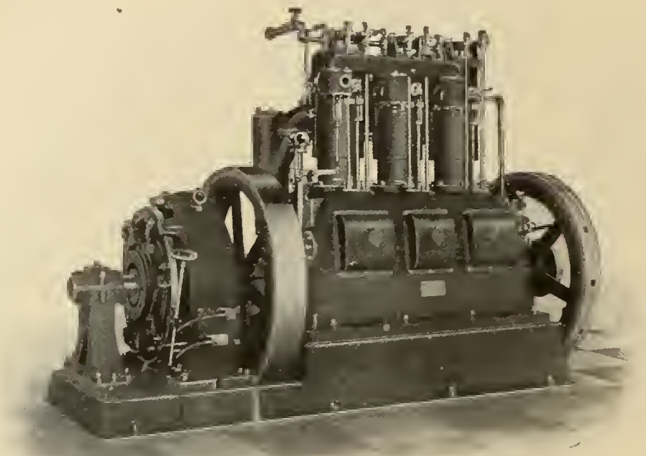
A REPRESENTATIVE of Canadian Machinery had the opportunity this week of looking over two installations of Campbell gas engines and suction gas plants. The first of these is a 26 brake horse-power Campbell engine, electric lighting type with suction gas plant of same size. The engine is of exceptionally heavy design, and for the power given it is probably the heaviest gas engine running in the Dominion; the fly wheel weighs nearly 7,000 lbs. The charge is ignited by means of a magneto of very simple but apparently very effeient type, no battery or dynamo is used and the spark is perfect even in starting. The suction gas plant is very simple in design and working, and sufficient gas is produced from less than 250 lbs. of coal per day.



Section and Plan of Fairbanks-Morse Gas Engine.

This plant is installed at the works of the Ryall Screw & Specialty Co., Montreal.

The second installation consists of a 20 brake horse-power engine of the same electric lighting type, and although differing in minor details from the 26 horse-power, it is essentially the same. This plant is running in the machine shops of Messrs. Beauvais Bros., at Laprairie, makers of agricultural implements. They certainly seem highly pleased with their engine.



Walrath Gas Engine.

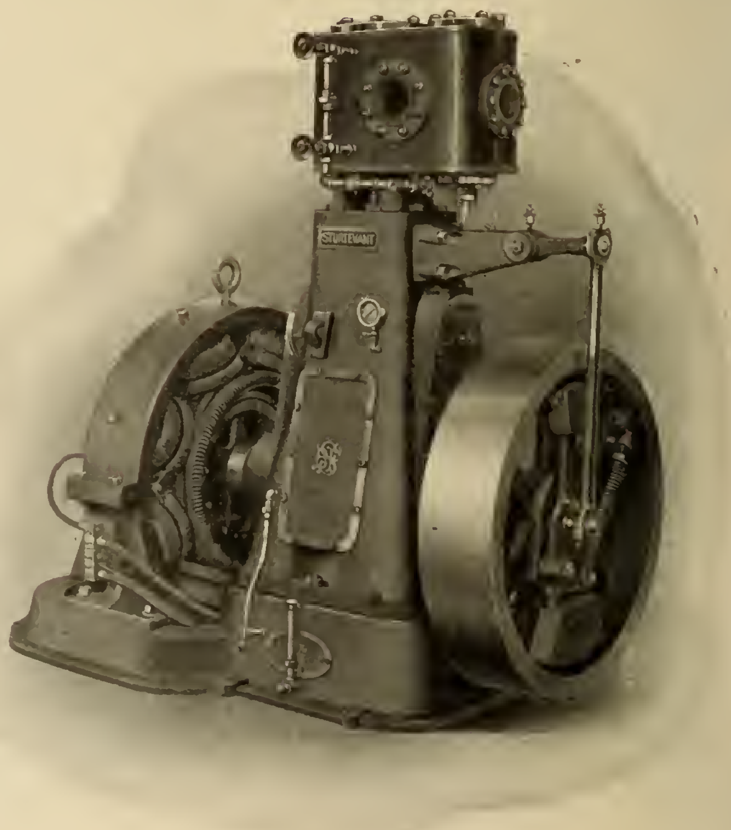
Both installations were put in by the Canadian agents of the Campbell Company Messrs. Wayland Williams & Dadson, 321 St. James street, Montreal.

ANOTHER STURTEVANT GENERATING SET.

THE B. F. Sturtevant Co., of Boston, Mass., have been developing, in a comparatively quiet way, a very complete line of small and medium size generating sets of exceptionally high efficiency. Among these is a series running from 7½ to 50 k.w. of the form illustrated herewith.

The engine of the set illustrated is of the single, vertical enclosed automatic type, with cylinder 9 inches in diameter by 8 inch stroke. The generator, like all others in its class, was specifically designed by the B. F. Sturtevant Co. for direct attachment to its respective size of engine. Its output is secured at 350 r.p.m. with 90 lbs. of steam. The shaft is 3 7-16 in. in diameter, the crank pin measures 4 in. in diameter by 4½ in. in length, and the complete set weighs 4,900 lbs.

The cylinder is fitted with balanced piston valve, is thoroughly insulated with magnesia and covered with Russia iron bound with polished iron bands. A watershed partition between the cylinder and the frame prevents the drip of water from the cylinder coming in contact with the oil in the main body of the engine. This watershed partition permits of access to the piston rod stuffing box while the engine is in operation. The frame is cast in one piece bored out to form the crosshead guides, and fitted with doors on either end and on the sides for accessibility to the reciprocating parts when adjustment or repairs are required. The lubrication of all bearing surfaces is made absolutely positive by means of a pump and a piping system which, in connection with relief and check valves and a pressure gauge, maintains a pressure of about 15 lbs. per square inch of oil on all the main bearings of the engine while in operation. This system not only assures the presence of oil on all bearings at all times without constant supervision, but what is more important, it maintains under pressure a film of oil between the two bearing surfaces which absolutely prevents their contact. Practically the friction is thus eliminated, and high mechanical efficiency is secured, ranging from 92 to 95 per cent., according to the size of engine. The regulation is accomplished by means of a Rites' flywheel inertia governor, simple in construction, durable and reliable in operation. The speed variation is limited within 2 per cent. between full load and no load. The crosshead is of cast iron with adjustable shoes, the connecting rod of forged steel with removable babbitted boxes, and the shaft of open hearth steel, forged in one piece, with cast iron counter weights bolted on.



New Sturtevant Generating Set.

The field frame of the generator is of cast iron with wrought iron pieces and cast iron shoes. The field coils are made up in two separate sections, the compound winding forming one and the shunt winding forming the other. The armature is of the barrel-wound, toothed, hollow-drum type, the windings be-

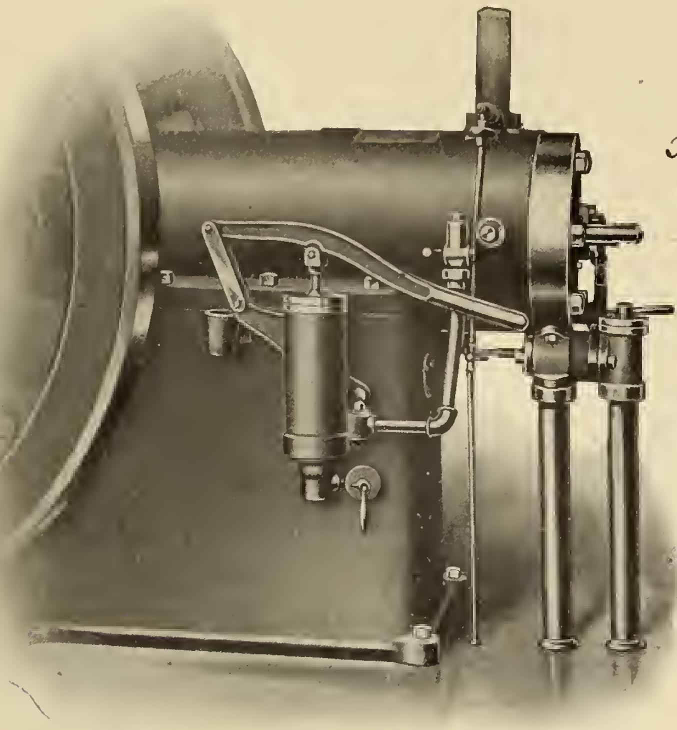
ing of the coil or bar-wound type. In the construction of the commutator the best drop forged copper is used, thoroughly insulated by selected amber mica. Self-adjusting socket type shunted brush holders are used. The spring is not called upon to carry any current; as a consequence there is no danger of its losing its tension from the heating. Soft carbon brushes are employed. The test for di-electric strength (or breakdown) is made with a pressure of 1,500 volts alternating E.M.F., for a duration of one minute, with a generator having a capacity of 7 k.w. The heat rise of the generator will not exceed 40 degrees C. for a four hour full rated load run. An overload of 25 per cent. can be carried for two hours without the temperature rise exceeding 50 degrees C., and a momentary overload of 100 per cent. without flashing.

THREE-CYLINDER VERTICAL GAS ENGINE.

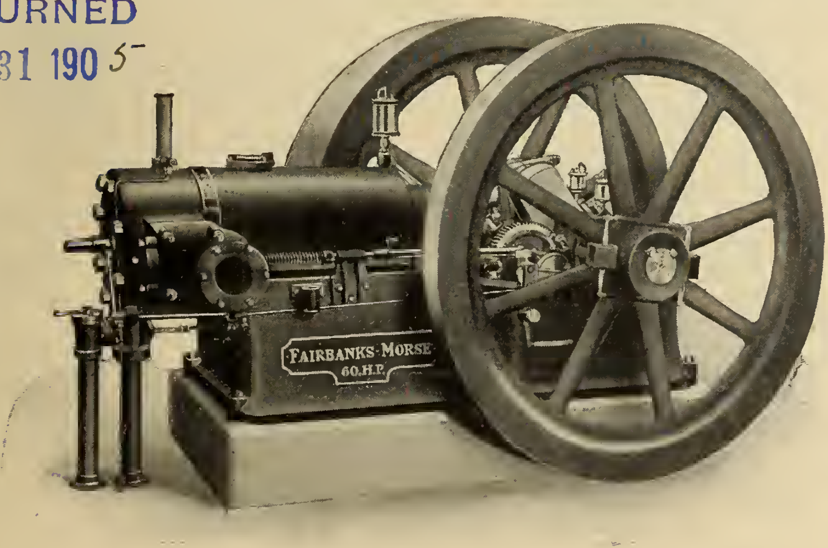
A SEVENTY-FIVE h. p. 3-cylinder direct connected gas engine is shown with generator of an extended shaft. It is one of the Walrath type manufactured by the Marinette Gas Engine Co., of Chicago Heights, Ill. This engine is built in three styles—one, two and three-cylinder, all of the vertical type. The three different styles embody the same mechanical construction. The base is cast in one piece, is accurately bored to receive the cylinder, crank and cam-shaft bearings, and the bottom is planed level, ensuring perfect alignment of the engine when installed. The main bearings are separate castings from the base, and are all turned up together on an arbor to fit in a corresponding part of the circular bore made to receive them in the base. These bearings are removable without disturbing the crank shaft, and are adjustable for wear. They are lined with genuine babbitt, and in special cases are lined with phosphor-bronze.

The cylinders are bolted to the top of the base, and fit into a bore made to receive them. This makes possible a perfect alignment and keeps them from getting out of true. Being of the vertical type, the cylinders are free to expand, without the objection of overhanging. They are cast of a special close-grain charcoal iron, and are water-jacketed to prevent over-heating. In the multiple-cylinder types the cylinders are cast separate. This is a distinct advantage in this type of engine. If one cylinder is damaged beyond repair, it does not necessitate an entire new set of cylinders.

The cylinder head is fastened to the cylinder with studs of sufficient size and number to ensure a tight joint. The cages which contain the valves are placed within the cylinder head. The company claims a special advantage from this feature, as the valve may be taken out for regrinding or cleaning without disturbing the head or any of its connections; and in the multiple-cylinder type any one of the cylinders may be cut out while the engine is running, permitting a change of valves or igniter plugs without stopping the engine.



End View Showing Patent Self Starter.



Fairbanks-Morse Gas Engine.

The valves are of the poppet type, and are two in number, one for inlet or explosive mixture, and the other for the exhaust. The valves have a positive lift and work vertically. On all sizes above and including ten horse-power, single-cylinder style, and twenty horse-power double-cylinder, both valves are placed in cages which fit into the cylinder head. The joint between the cages and head is ground so that to remove either valve is the work of a few minutes. This is done without breaking any water joints or gaskets.

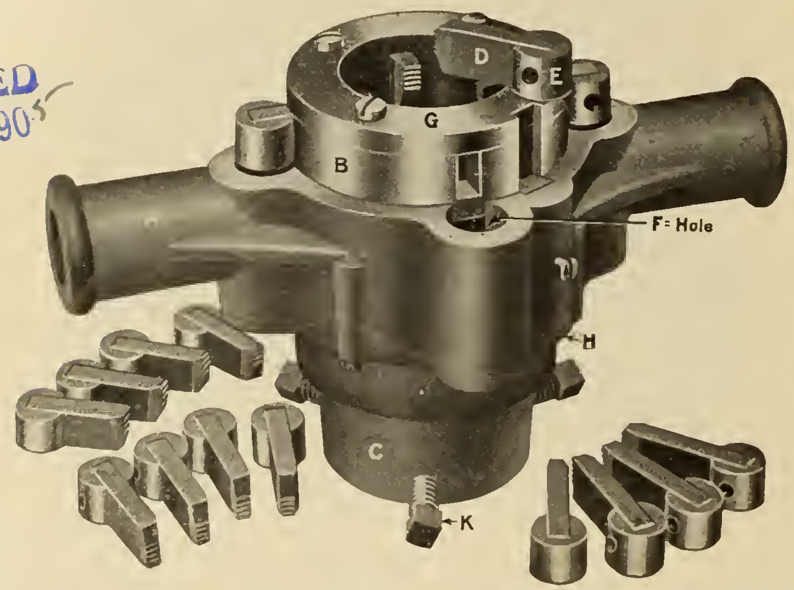
These engines are adapted to run on natural, artificial, illuminating or producer gas, gasoline, distillate, kerosene or crude oil. The cost of fuel for operating a Walrath engine varies from 0.002 cent to 0.015 cent per horse-power per hour, according to the quality of fuel used and the price.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

THE "JARDINE" PIPE DIE.

THE accompanying illustrations are of the "Jardine" patent pipe die, originated and recently placed on the market by A. B. Jardine & Co.,



"Jardine," Pipe Die.

Hespeler, Ont. The new feature in this die is embodied in the manner of obtaining the taper on the pipe. The ordinary solid pipe die is made the correct size with the required taper, and is screwed right onto the pipe, the back of the die reducing the point of the thread to give the required taper. After the adjustable die is adjusted it cuts on the same principle as the solid die. The "Jardine" die is made like and cuts on the same principle as the bolt die. That is, the die is chamfered off on the advancing side for two or three teeth, and thus most of the cutting is done by these teeth, the following teeth simply sizing. The taper is obtained as shown in figures 1 and 2. The body, B, carries the cutters, D, and slides freely up and down in the stock, A, but is prevented from sliding around by the key and keyway shown. A leading screw is cut on the outside of the body, B, with the same pitch as the thread required to be cut on the pipe. As the stock and body, B, revolve, B is drawn into the barrel, C, by the thread on the inside. As B is drawn into the barrel it slides down the four slides, F, in the stock, A, which slides are bored at an angle to the axis of the stock which will give the standard taper for pipe thread. Then as B advances the cutters are pressed out against the walls of the slides, and thus the thread on the pipe is cut with the required taper.

The advantage claimed for the die is the ease with which a thread can be cut

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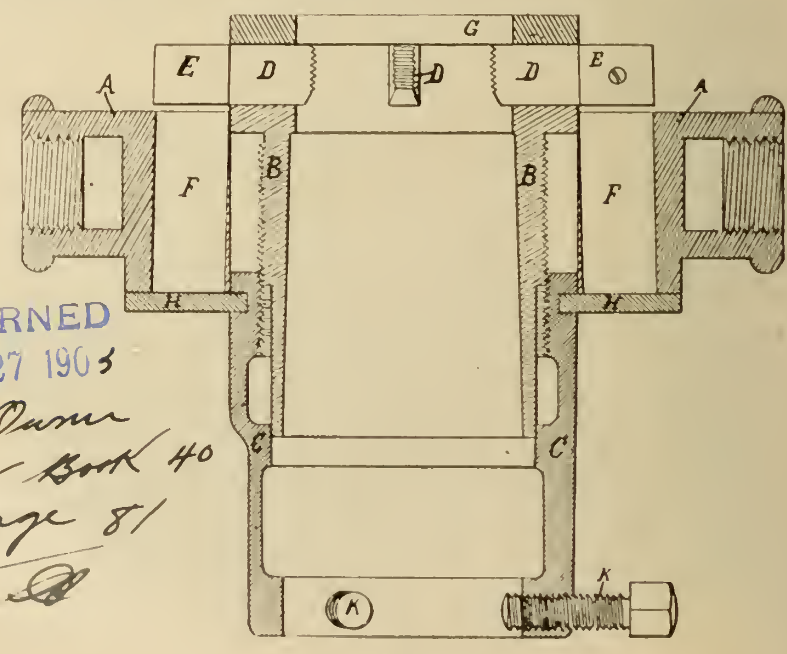


"Jardine" Pipe Die.

compared with ordinary dies, the first three or four threads doing all the work, and the consequent saving of time. To substantiate their claim of time saving, A. B. Jardine & Co. had a test made, which showed that the work that it took a competent steamfitter one hour and 23 minutes to perform with the best type of ordinary die could be done by one of their men with their die in 44 minutes. Besides which the steamfitter required assistance in cutting 2-inch pipe, which assistance was not needed with the "Jardine" die.

NEW TURRET PUNCH.

A TURRET punch, calculated to meet the requirements of a large number of people who have a certain amount of punching to do, but who do not feel warranted in installing an expensive machine, has been placed on the market by Taylor & McKenzie, Guelph, Ontario. There is a field for a punch of this kind, inasmuch as it enables different sized holes to be punched without being under the necessity of changing the punches and dies, resulting in a large saving of time usually taken up in changing from one set to another when but one head is used. This is particularly true where small jobs or repair work is being done.

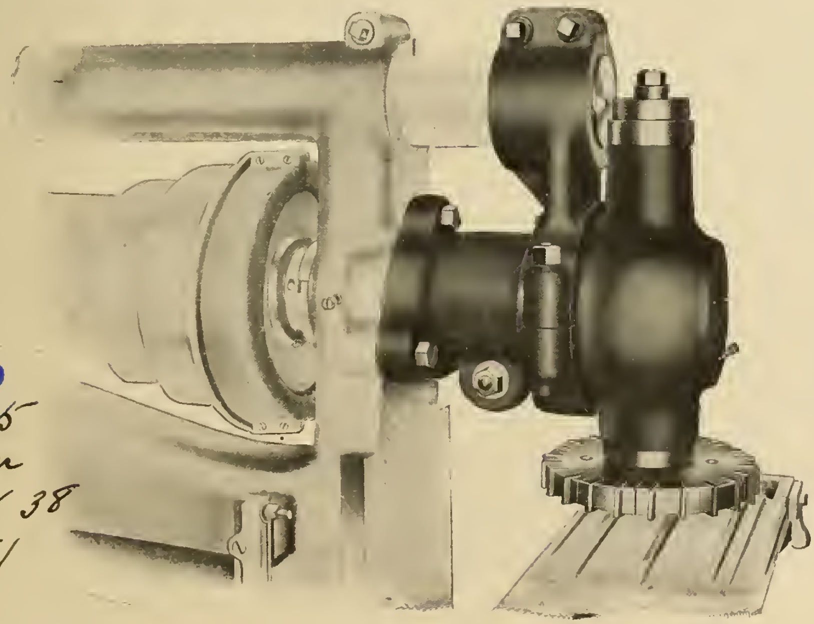
The drawing reproduced shows the punch in plan and elevation. As will be seen, it has six punches. These are

of different sizes, and always in position and ready for work. All that is necessary to change from one size to another is to revolve the turret and bring the desired punch under the lever. It is a powerful machine and punches holes up to 1-2 inch in heavy band iron with ease. Six punches and six dies are furnished with each machine, sizes being 3-16 inch, 1-4 inch, 5-16 inch, 3-8 inch, 7-16 inch and 1-2 inch, unless ordered otherwise. The punches and dies are made interchangeable. Any further information regarding this machine will be furnished by the above mentioned firm.

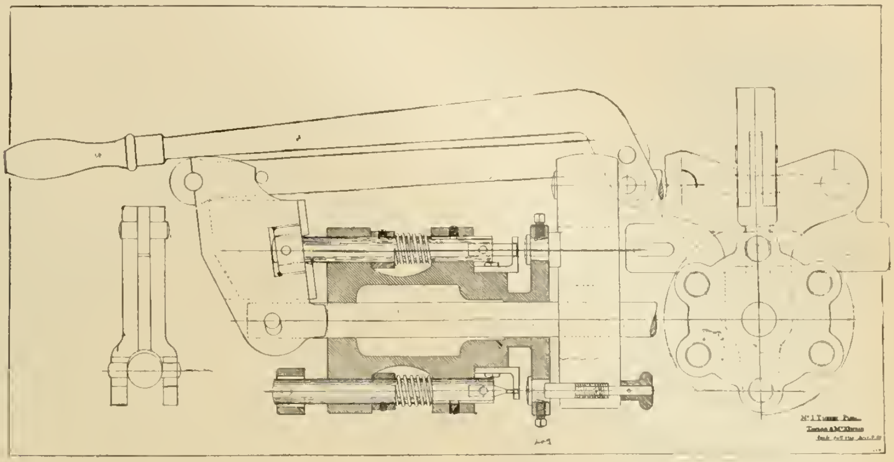
A NEW VERTICAL MILLING ATTACHMENT.

IN these days of manufacturing milling, the vertical milling attachment on the horizontal miller plays a very important part. The illustration shows an interesting vertical milling attachment, extra heavy and powerful pattern, just brought out by the Kempsmith Mfg. Co., of Milwaukee.

It is designed primarily for massive strength and rigidity, sufficient to handle without undue strain the very heaviest classes of vertical milling which the power of the main spindle itself will stand, thus in effect converting a powerful horizontal miller into just as powerful a vertical miller. With this end in view the attachment, as will be noticed from the illustration, is constructed throughout along the most compact, simple, and powerful lines. Everything in the way of a frail or superfluous construction has been successfully avoided.


Vertical Milling Attachment.

The bevel gears in the head are large face and coarse pitch, of steel, and case hardened. The vertical spindle runs in unusually long bearings, in order to maintain a perfect alignment, and the lasting wearing qualities are far greater than any other similar attachment. Provision is given for delicate adjustment for wear. The head can be swiveled to any angle of 360 degrees, being graduated, and its construction requires only two bolts to be handled in adjusting and clamping the head securely at any angle. Both bolts are very conveniently located. The horizontal bolt clamping the head in the bracket has unusually rigid clamping power, being a friction bolt of improved type. The vertical spindle has taper hole and is threaded for large face milling cutters. Both the taper hole and thread are the same as on the main spindle, thus making all tools interchangeable. Drawbolts are furnished for drawing in and backing out the end mills, the advantage in this being well known. The design of the head keeps the distance from the centre of the horizontal spindle to the nose of vertical spindle very short, so as to permit of doing work unusually high from the table.


New Turret Punch.

The attachment is drilled to the same jig as the columns of machines for which it is intended, so that it can be applied to any Kempsmith miller, of certain sizes, now in use. The attachment is built in three sizes, and any further information regarding specific power, tests, and so on, will be cheerfully furnished by the makers.

ELECTRIC SWITCH.

THIS electric switch, the joint invention of B. Hughes and H. Young, Montreal, is fully covered by United States and Canadian patents. The design and development is in the hands of Albert E. Smaill, mechanical engineer, Montreal, who is also associated with above in placing same on market.

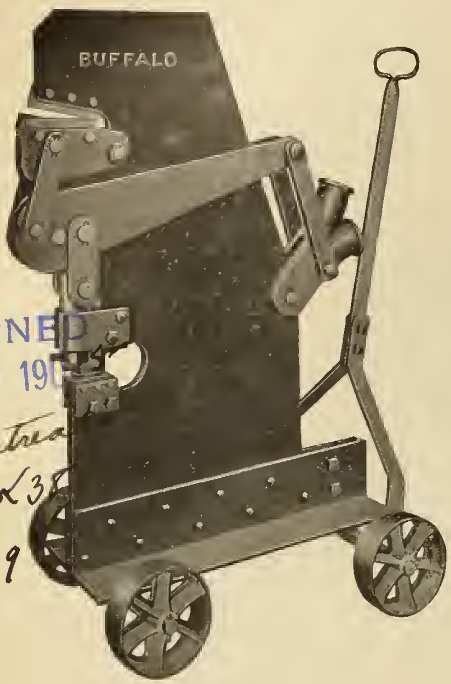
It is essentially similar to a compass with electric contacts mounted on same centre pieces as needle. The needle and contacts are magnetically held in the neutral position and the swinging to either side being controlled by two pole pieces at right angles to normal position.

The switch can be applied to any use requiring the control of electric currents without actual contact between operator and switch being required, such as a block system on railroads, or the operation of track switches on electric railways.

The switch as at present developed is arranged for the operation of track switches on electric railways, the operation being under the complete control of the motorman, and does not require the car to be slowed down or the motorman even to see the switch. It does not require any alteration to the road bed, such as insulated rails, etc., and is entirely proof against all damage due to hard

usage, climate, frost or wet, and is in every way thoroughly reliable.

In this application the electric switch is buried beneath the road-bed at a convenient distance away from the track switch, the outside or controlling pole pieces being carried up to the surface of



Armour Plate Tool.

the road. The leads from the switch are taken to two solenoid magnets, which are in an oil-filled case beside track switch.

On the car there is a pilot magnet attached to the truck in such a position that its poles will pass over the pole pieces of the electric switch buried beneath the road-bed, at the same time clearing them by at least four inches.

The operation is as follows: On approaching the track switch the motorman sets the handle of a pilot switch in his cab, in the direction he wishes to go. This controls the polarity of the pilot magnet on truck, which in turn magnetically affects the pole pieces in road-bed, and thus causes the electric switch arm to swing over in the desired direction, and close the circuit of the solenoid at track switch, which in turn pulls switch tongue in proper direction.

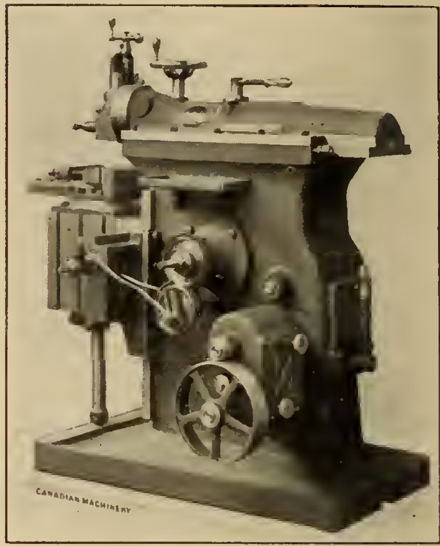
The attachment of the switch tongue is of such design that it requires very little alteration to the switch bed, and leaves the tongue entirely free, so that it can also be moved if desired with the ordinary switch iron.

There is also an alternative arrangement by which the switch will be brought into action by means of a locomotive, or similar iron or steel mechanism passing over it. The arrangement will work equally well in all weathers.

ARMOUR-PLATE TOOL.

CAST-IRON punches and shears have long been found unsatisfactory on account of flaws developing from shrinkage, cracks, and other causes. When thicker metal is used the machine is heavy and cannot be easily moved around the shop. For these reasons armour plate tools have been developed by the Canadian Buffalo Forge Co., Limited, of which the body is constructed of a single plate of armour steel with which the great tenacity of the metal gives a large capacity with little weight. As all fittings are machined from solid steel, the tool is practically indestructible, and the wearing qualities and strength of these tools are assured.

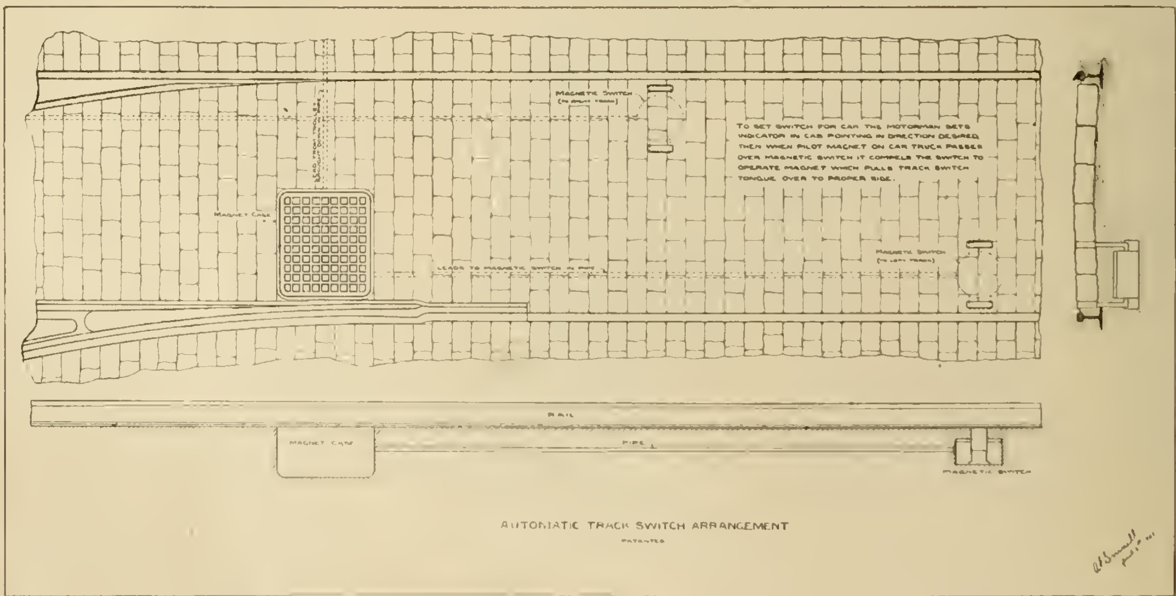
The above cut shows the largest size mounted on a truck. It may be easily rolled from point to point, and as it possesses the capacity of a power punch its uses are invaluable for boiler shops, structural steel works, and machine and forge shops in general, as it will take a 6 x $\frac{5}{8}$'' bar, it will cut a 6'' angle iron in two cuts. It will also punch a $\frac{3}{4}$'' hole in $1\frac{1}{2}$'' plate without any difficulty. The jaws of the shear are carefully pro-



New Design Cincinnati Shaper.

portioned for the work and are guaranteed not to spring nor warp under continual use at these ratings.

Many other types and sizes have been developed all with armour plate body, and similar tools such as angle iron cutters, tire benders, and tire upsetters, have also been designed of which the makers, the Canadian Buffalo Forge Co., Limited, have prepared a catalogue giving full descriptions and ratings.



CINCINNATI CRANK SHAPER.

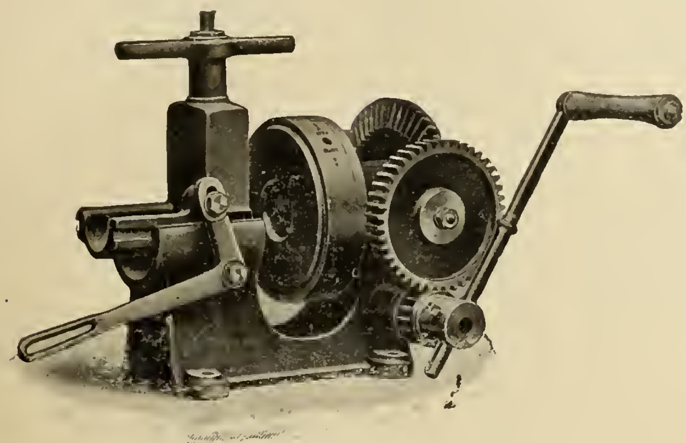
THE illustration shown herewith represents a new design of a back-geared crank shaper, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio. The particular feature of this machine is the gear box, seen in the illustration, which provides all changes of speed attainable through the usual cones and having the further advantage of affording a larger area of belt contact at all speeds without shifting the belt. In this gear box there are three shafts, two of which carry sliding gears; the hand nut shown readily moves and rocks these gears. This box can be attached to any of the back-geared shapers manufactured by this company at any time, although it is preferably done while the machines are in process of construction. The other features of the shaper are of the standard type, such as have been manufactured previously.

The construction of the ram reciprocating mechanism is interesting. The journal of the main gear has two diameters, the diameter of the inner end being twice that of the outer end, to overcome any tendency to break at the junction of the gear. The crank block is a steel forging and is set well into the cup of the gear, permitting the rocker arm to travel close to the edge of the gear, thus avoiding the usual overhang. The rocker arm is strong and heavy, and has means for compensating for wear.

PIPE-FITTERS' SCREWING MACHINE.

A NEW model of screwing machine has been designed by Chas. Winn & Co., Birmingham, to meet the demand for a lighter and cheaper tool embodying the labor-saving features of the more expensive machine as far as possible, the necessary economy being effected without any drawback to the strength and durability.

The vise is self-centering and of novel design, arranged to give the maximum strength, and will hold firmly all sizes of tubes from $\frac{1}{4}$ to 2 inch, inclusive, without splitting or distorting them; it will also hold $1\frac{1}{2}$, $1\frac{3}{4}$ and 2 inch bends. Three dies are provided, each consisting of a set of four chasers of ample strength, to screw tubes of the sizes named, $\frac{1}{4}$ to 2 inch, inclusive, and these dies screw the standard sizes when adjusted to the marking on the edge of the die-box; but they are adjustable, if required, to screw tubes larger or smaller in diameter than the standard size; while they can at any time be sharpened by grinding them upon a stone like an ordinary chasing-tool without softening.



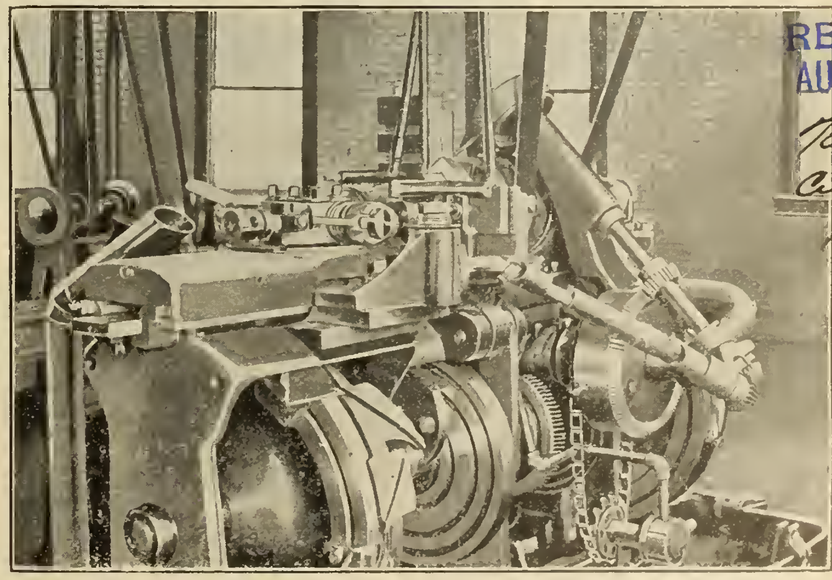
New Pipe Screwing Machine.

There is no necessity to wind the machine backwards after screwing a thread as an instantaneous releasing motion is provided, operated by loosening a nut at the back of the die-box. The machine is double-geared to give ease in working and the driving lever is adjustable in stroke to provide a leverage suitable to the different diameters of the tubes being screwed, thus saving time; while it has been kept as light and compact as possible and is, therefore, easily portable, the weight being under 150 lbs.

AUTOMATIC SCREW MACHINE.

THE important features of a new automatic screw machine made by the Automatic Machine Co., Greenfield, Mass., are a system of adjustable cams which are held in T slots on the drum, a new friction clutch for reversing the spindle without shock and the use of a single belt for driving all of the moving parts. The illustration shows how the spindle is driven.

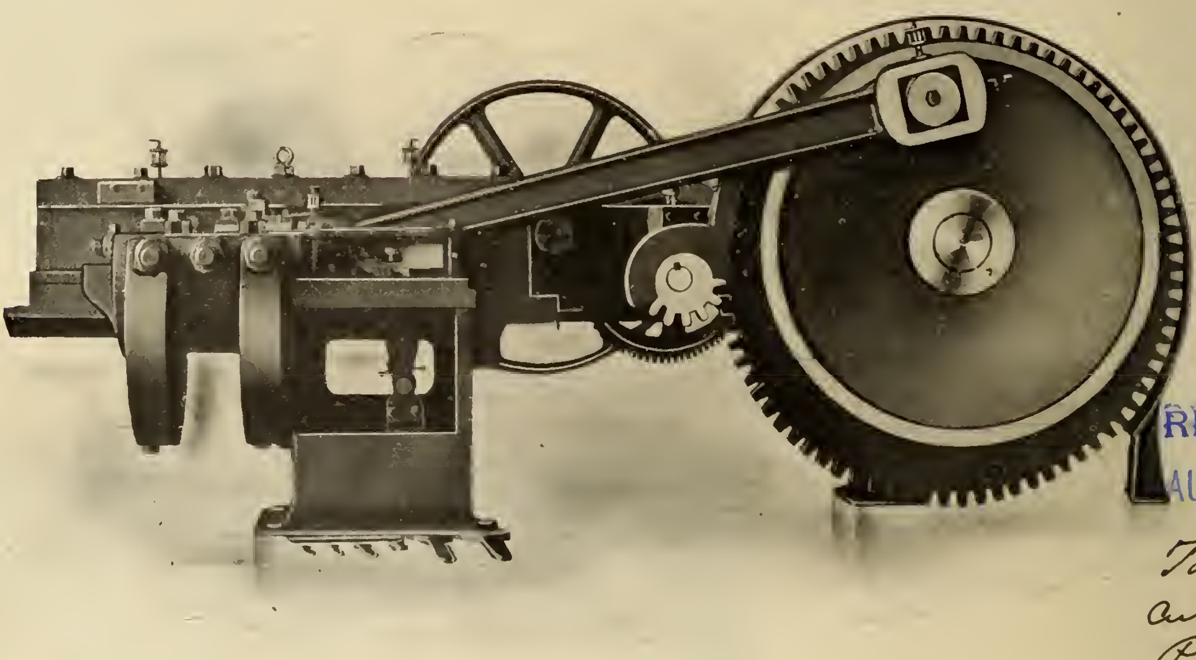
The belt drives a pulley on a shaft set obliquely, and upon which are bevel gears transmitting power to a cross shaft, which in turn supplies the drive of the cam shaft. On the oblique shaft are three gears which provide two speeds to the cam shaft, one a direct drive and the other a slower one through the third gear, acting as a back gear. The change of speed is accomplished by the use of set screws. This form of drive from the single belt tends to avoid certain possible accidents, such as would result from the breaking of the belt driving the spindle. Under this system, if the belt breaks or runs off, the power is also taken from the feed mechanism and no damage could be done to the work or tools. The intermediate pulley is placed in such a position that a large percentage of all pulley surface is covered, thus making effective belt contact, as well as driving the feed mechanism. The latter may be operated by hand by the hand wheel, shown in Fig. 1, beneath the spindle pulley.



Automatic Screw Machine.

HEAVY THREAD ROLLING MACHINE.

THE process often used in preference to cutting the thread upon wire and screw blanks with ordinary threading dies is that of rolling the threads by means of which greater rapidity and economy are retained. By this means the blank to be threaded is rolled between dies whose surfaces are grooved to suit the shape of threads and at an angle corresponding to the pitch of the screw. During the operation the stock is displaced, but none of it removed, with the result that the finished groove is larger in diameter than the blank. The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., make a line known as reciprocating groove threading machines for the purpose of doing this work, cut of which is shown.



Reciprocating Screw Threader.

The machine has one stationary die and one moving or reciprocating die. The blanks are introduced between these dies and are rolled between their faces, perfect threads of uniform size being rapidly formed. The dies for this work are easily made and are very durable. The No. 7 will handle about 20 blanks per minute and will roll a length of thread up to and including 3½ inches. The driving pulley is 43 inches in diameter, runs at 240 revolutions per minute and is geared to the crank disk with a ratio of 1 to 13½. The machine occupies a floor space of 77x173 inches and weighs about 18,700 pounds. It is provided with roller bearings to reduce friction, a quick return movement for the slide and an improved knock-off.

PROGRESS IN STEEL WORKS.

ONE of the latest ideas, which is about to be carried out on a very large scale with regard to steel rail mills, is that the rolls shall be driven by motors whose powers will be developed by gas-engines driven by the gas from the blast furnaces. The power thus obtained will be delivered as current to motors at the rolls, to which they will be connected by gear, and will supplant the present steam-engines now in use for driving these rail mills. The improvement in plate-mills for rolling steel plates is as great as that which has taken place in the steel-rail mill. Five and thirty years ago a plate-mill making 100 tons of plates per week was considered to be doing fair work. To-day a mill making a similar class of steel plates, but of much larger area, is turning out easily about eighteen times that quantity, and in America the enormous make of 450 tons has been rolled in twelve hours. These large quantities are again due to improvements brought about by mechanical appliances, for handling large ingots or blooms weighing as many tons with greater ease than was formerly the case when the weight of the ingots was only hundredweights handled by manual labor. Krupp was considered to have done marvellous work in showing an ingot weighing about a couple of tons at the Exhibition in 1851, though it must be remembered that this was made from crucible steel. To-day ingots can be made of almost any weight, and their size is practically governed by the power of the appliances used for moving them. At the St. Louis Exhibition a model was shown of a cylinder weighing 150 tons which had been cast in nickel steel for a 10,000-ton forging-press. Ingots of 60 tons' weight for armor-plates are not infrequent. In plate-mills the improvements in rolling-engines, the adoption of universal rolling trains, enormous hot slab shears, cranes of all descriptions for handling, charging, and drawing material from heating furnaces, cooling and straightening roller tables, cold shears capable of cutting plates up to 2½ inches thick, cooling-floors fitted with castor rollers by which these heavy plates are easily moved, have all contributed to the great outputs of steel rolling-mills, and have enabled steel plates to be produced at prices not dreamt of in former years. This, in its turn, has had a beneficial effect on shipbuilding, so that vessels are to-day being built of this splendid material at a lower cost than perhaps at any previous period in the history of the trade. The reduced price of plates has again reacted on the cost of vessels. While referring to the improvements in making steel plates and rails, one must not omit to mention the great strides made of late years by hydraulic forging. The forging-press has been much improved upon. Hydraulic presses of 5,000 and even 10,000 tons are not uncommon, and for working large masses the hydraulic forging press seems to have almost replaced the steam-hammer. Another matter that should be mentioned is the progress made in electric smelting. Although this may not be applied largely to ordinary steel-making, there is little doubt that it has a large field open before it for the production of valuable iron alloys

Companies Incorporated

The Boundary Iron Works have been incorporated at Victoria, B.C., to carry on a general foundry business.

Canadian Oil Co., Limited, have been granted the right to increase their share capital from $1,000,000 to $1,500,000.

The Canada Wire & Nail Co., Sydney, N.S., have been organized with a capital of $200,000. J. E. Burchell, Sydney, is interested.

The Western Canada Cement and Coal Co., Limited, of Ottawa, have been incorporated with a share capital of $1,250,000.

The Raymond Mfg. Co., of Guelph, Limited, has been granted power to increase their capital stock from $130,000 to $250,000.

The Hickey Oil Co., of Arizona, has been licensed to do business in Ontario. H. F. Slater, of Leamington, is the company's attorney.

The Pollock Mines Co., Yale, B.C., have been incorporated with a capital of $1,000,000, to carry on a mining, smelting and refining business.

The South Bay Oil Co., of Ohio, has been licensed to develop oil property in Ontario. G. G. Moncrieff, of Petrolea, is the company's attorney.

The New Ontario Iron Co., of Maine, has been licensed to develop mining property in Ontario. Clara Brett Martin, Toronto, is the company's attorney.

Concrete Steel & Tile Construction Co., of Michigan, has been licensed to do construction business in Ontario. Gus Kahn, Toronto, is the company's attorney.

New York Oil Co. have been granted the right to do business in Ontario to the extent of $1,000,000. W. A. Brake, of Leamington, has been appointed to be their attorney.

R. Scott & Son, Limited, Galt, share capital $100,000; purpose, to manufacture wooden work for wagons, etc. The directors are: R. Scott, E. Scott, and E. Scott, all of Galt.

The Gananoque Bolt Co., Limited, have been authorized to transact all matters comprised wit in the powers of the said company with W. T. Sampson, Gananoque, its attorney.

Russell Elevator Co., Limited, Toronto, share capital, $20,000; purpose, to manufacture and deal in elevators. The directors are: J. Russell, A. Russell and C. Q. Parker, all of Toronto.

Canada Radiator Co., Limited, have been authorized to issue one thousand five hundred shares of preferred stock of the company. The board of directors is to consist of seven, as at present.

The Ajax Production Co., of the State of Delaware, have been granted the right to carry on the business of an ail company to the extent of $40,000. G. A. McGilivary, of Petrolea, is attorney.

The Sharples Separator Co., of the State of Pennsylvania, have been granted the right to manufacture and sell centrifugal separators to the extent of $40,000, with C. A. Masten as its attorney.

M. Beatty & Sons, Limited, of Welland; share capital, $300,000; purpose to manufacture and sell machinery of all kinds. The directors are: W. L. Beatty, H. L. G. Beatty and A. O. Beatty, all of Welland.

Crescent Oil and Gas Co., of the State of Arizona, have been granted the right to do business in Canada to the extent of $1,000,000. W. A. Brake, of Leamington, has been appointed to be their attorney.

Macdonald Engineering Co., Limited, of the State of Illinois, U.S.A., have been granted the right to build, construct and equip grain elevators in Ontario. W. H. Adamson, of Toronto, is their attorney.

American Radiator Co., of the State of New Jersey, have been granted the right to manufacture and deal in radiators, boilers, etc., and to do business to the extent of $50,000. N. Whitelaw, of Brantford, is its attorney.

The Dennis Wire & Iron Works Co., Limited, of London; share capital, $50,000; purpose to manufacture and deal in architectural and ornamental metal work. The directors are: J. H. T. Dennis, E. R. Dennis and C. H. Ivey.

The Capewell Horse Nail Co., Limited, of the State of Connecticut, have been granted the right to manufacture and sell machinery, horseshoe nails, etc., to the extent of $400,000. C. H. Fleming, of Toronto, is its attorney.

The York Brick & Cementware Co., Limited, Lambton Mills, share capital $40,000; purpose, to manufacture and sell brick, cementware, etc. The directors are: Wm. Beith, Toronto; R. Weddell, Trenton, and R. Beith, Bowmanville.

The Automatic Train Stopping Co., Limited, Toronto, share capital $250,000; purpose, to manufacture and deal in air compressors, electrical machines, etc. The directors are: W. R. P. Parker, G. M. Clark and J. A. McEvoy, all of Toronto.

Western Canada Cement & Coal Co., Limited, Ottawa, share capital $1,250,000; purpose, to manufacture cement and building materials. The directors are: A. F. MacLaren, W. A. Fleming, C. A. Irvine, J. Lavelle and S. F. Bell, all of Ottawa.

Toronto Welsbach Light Co., Toronto, share capital $50,000; purpose, to manufacture lighting apparatus. The directors are: J. G. Lohrman, of Elkhart, Ind.; J. R. Adamson, J. Fleck, F. J. P. Gibson, and G. C. Arnott, all of Toronto.

Canadian Seamless Wire Co., Limited, Toronto, share capital $50,000; purpose, to manufacture and deal in wire, etc. The directors are: W. B. Gladding and E. H. Fairbrother, of Providence, R.I., and H. E. Smith and H. P. Smith, of Cranston, R.I.

Osborne Oil Producers, Limited, Petrolea, share capital $100,000; purpose, to develop oil wells and gas lands. The directors are: J. Armstrong, Owen Sound; W. McIntosh, Petrolea; Peter Ryan, J. A. McIntosh and D. Urquhart, all of Toronto.

The Matthews Turbine Co., Limited, of Toronto; share capital, $100,000; purpose, to manufacture and deal in goods, wares and merchandise. The directors are: E. MacKenzie, T. Lawless, C. B. Jackes, J. P. Murray and J. P. Beaty, all of Toronto.

The Mexican Electric Light Co., of Ottawa, share capital, $6,000,000; purpose, to carry on an electric light, heat and power business in Canada. The directors are: A. R. Doble, E.McK. Edgar, L. L. Edgar, C. F. Hibbert and L. Colwell, of Ottawa.

Seibert Curtain Pole Co., Limited, Toronto, share capital $20,000; purpose, to manufacture articles out of iron, metal, wood, fibre, etc. The directors are: T. C. Seibert, E. J. Butler, E. Williams, J. Williams, and E. Lewis, all of West Washington, Pa.

Petrolia Torpedoes Co., Limited, of Petrolia, share capital $50,000; purpose, to pursue mining operations for oil, water, gas and other minerals. The directors are: D. Barr, of Dutton, Ont.; W. M. Lowery, of Petrolea, and J. H. Kittermaster, of Sarnia.

Seibert Curtain Pole Co., Limited, Toronto, share capital $20,000; purpose, to manufacture articles made from iron, metal, wood and fibre. The directors are: T. C. Seibert, E. J. Butler, E. Williams, J. Williams, and E. Lewis, all of West Washington, Pa.

Model Building-Stone Co., Limited, of Montreal, share capital, $20,000; purpose, to manufacture and sell building and cement stone, etc. The directors are: J. Boddy, A. Valin, D. Loynachan, J. E. Wilder, all of Montreal, and J. M. Reid, of Outremont, Que.

The Canada Sand-Lime Pressed Brick Co., Limited, of Toronto Junction; share capital, $60,000; purpose to manufacture and sell brick, etc. The directors are: R. Kennedy, W. M. Flavelle, J. Carew, J. D. Flavelle and J. M. Squire, all of Lindsay.

Fairbanks-Morse Canadian Manufacturing Co., Limited, of Toronto; share capital, $250,000; purpose to manufacture and deal in tin, iron, steel, etc. The directors are: G. W. Sparks, of Chicago, Ill., and C. J. Brittain and A. W. Holmested, of Toronto.

The Ottawa Cement Block Co., Limited, Ottawa, share capital $10,000; purpose to carry on the business of manufacturing and dealing in cement blocks, etc. The directors are L. S. Macoun, F. D. S. LeMoine, G. S. May, R. Wright and C. A. Irvine, all of Ottawa.

Western Construction Co., Limited, of Toronto, share capital $4,000,000; purpose, to carry on a general contracting and construction business. The directors are: A. P. Murray, J. G. Pyke, F. H. Hewitt, P. M. Robertson, and Geo. Smith, all of Montreal, Que.

The Rideout Gilbert Co., Limited, of the Province of Manitoba, have been granted the right to manufacture and sell tableware, hardware, etc., and to do business in Ontario to the extent of $40,000. Harding Rideout, Rat Portage, has been appointed to be its attorney.

R. Macfarlane & Co., Limited, of Montreal, share capital $100,000; purpose, to carry on the business of general contractors and builders. The directors are: H. D. Smith, of Compton, Que., and R. Macfarlane, F. S. Macfarlane, R.

E. Parker, and F. G. Bush, all of Montreal, Que.

Toronto Construction Co., Limited, of Toronto, share capital, $200,000; purpose, to carry on the business of general contractors. The directors are: G. S. Deeks, and A. B. Cook, of Toronto; W. Winters, of Spokane, in the State of Washington, and H. H. Boomer and T. H. Hinds, of Butte, Ma.

Kakaheka Power Co., Limited, Fort William, share capital $2,000,000; purpose to carry on the business of power and electric heating and lighting. The directors are: H. S. Holt, C. R. Hosmer, F. W. Thompson, and H. W. Norton, all of Montreal, Que., and F. H. Phippen, Winnipeg, Man.

Port Rowan Natural Gas Co., Limited, of Port Rowan, share capital, $40,000; purpose, to drill for, pipe, use and sell natural gas for purpose of light, heat and power. The directors are: C. S. Killmaster, J. L. Buck, F. H. Pearsall, W. O. Franklin, J. Hanson and E. Meek, all of Port Rowan.

Kakeheka Power Co., Limited, Fort William, Ont., share capital $2,000,000; purpose, to carry on the business of power and electric heating and lighting company. The directors are: H. S. Holt, C. R. Hosmer, F. W. Thompson, H. W. Norton, all of Montreal, Que., and F. H. Phippen, Winnipeg.

The Standard Wire Fence Co., of Woodstock, Limited, Woodstock, share capital $100,000; purpose, to manufacture and deal in all kinds of metal fencing. The directors are: J. L. Hosack, G. H. Cock, and C. Jones, of Woodstock; A. M. Keeney, of Ann Arbor, Mich., and G. Robb, of Windsor.

Chatham Steam Heating Co., Limited, of Chatham, share capital, $40,000; purpose, to conduct a works for the production of electricity, etc., for purposes of light, heat and power. The directors are: G. W. Kipp and E. Whalen, of Towanda, and J. T. O'Keefe, W. N. Warburton and N. H. Stevens, of Chatham.

The Brintnell Adjustable Roller Bearing Co., Limited, Toronto, share capital $100,000; purpose, to manufacture and deal in roller and other bearings and machinery. The directors are A. Nelson, E. H. Adams, A. S. Dewar, A. L. Lougheed, W. H. Scott, C. D. Scott, A. H. Brintnell, and J. E. Cook, all of Toronto.

INDUSTRIAL PROGRESS

Machinery and Manufacturing News would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

THE public have read much of the coal deposits at Medicine Hat, but few have had any idea of its natural gas supply. According to Mayor Forster, the supply is so abundant that gas is furnished to the citizens at 17½ cents per thousand cubic feet for power, light and heating purposes. One of the largest stores in Medicine Hat is well lighted at a cost of 80 cents per month. The proprietor of one of the finest residences in the town paid $60.50 for a whole year's supply of gas for heating during the Winter, lighting the year round and fuel for cooking purposes. A special rate is quoted for manufacturers. Any manufacturer investing $10,000 and employing ten or more hands can secure gas at 5 cents per thousand cubic feet. The town waterworks, the C.P.R. workshops and every industry in the town are operated with natural gas, while the city streets are lighted by a 750-candle-power arc lamp at a cost of 4 cents per night.

Owen Sound is to have a new post office.

A $30,000 school is to be erected at Virden, Man.

James Marshall will erect a $20,000 hotel at Phoenix, B.C.

Charles Myles will erect a $20,500 warehouse at Hamilton.

A new hotel and theatre building is to be erected at Vancouver.

A $6,000 Roman Catholic church is to be erected at Rainy River.

Messrs. Calhoun & Ferguson will build a large hotel at Edmonton.

Swift & Co., Chicago, will erect a $200,000 plant at Vancouver.

The Welland-Thorold Electric Railway is to be constructed at once.

The Cockshutt Plow Co. will build a three-storey building at Regina.

The Brantford Screw Co. may extend their works in the near future.

New machinery is being installed in the brickyards at New Westminster.

The A. K. Melbourne Co. are erecting a $6,000 warehouse at Hamilton.

W. S. Sandhoff, of Oxhow, Man., will build an $18,000 hotel at Estevan.

The Penman Mfg. Co., Paris, are to erect a large five-storey warehouse.

J. B. Mack, Prince Albert, has secured a site for a grist mill at Vonda, Sask.

Mason's mills, burned down at Ottawa recently will be rebuilt and enlarged.

Pither & Leiser, Victoria, are to erect a three storey warehouse in Vancouver.

It is said that a large departmental store building will be erected in Hamilton.

Bedford & Mitchell, Melita, Man., are building a new machine and blacksmith shop.

Emery & Thompson's sash and door factory, at Fort Frances, is nearly completed.

The Montreal Steel Works Co. have purchased a site and will extend their works.

Alterations and additions to be made to the Hamilton Opera House will cost $24,000.

C. F. Jackson & Co., Vancouver, are to erect a three-storey warehouse, 100 x 60 feet.

The St. John, N.B., Foundry Co. are to double the capacity of their stove foundry.

The electric lighting plant at Windsor will be remodeled and enlarged at a cost of $30,000.

Chas. S. Bridgman, Winnipeg, is to construct a warehouse 100 x 120 feet in Winnipeg.

H. O. Bell-Irving is erecting a three-storey store and apartment building in Vancouver.

T. R. Vardon, MacGregor, invites tenders for the erection of a municipal hall, 34 x 24 feet.

The Canadian Northern Railway Co. will erect a station and freight sheds at Prince Albert.

Geo. Miller, Oakbank, will receive tenders for the erection of a municipal office building.

The Plymouth Cordage Co. have decided to accept Welland's offer and locate a factory there.

The British Columbia Telephone Co. are rebuilding their line from Cascade to Phoenix, B.C.

The McLeod Electric Light & Power Co. have installed an electric plant at Coleman, Alta.

The Brackman-Ker Milling Co. will erect a warehouse and wharf at New Westminster, B.C.

The Lake of the Woods Milling Co. will erect an elevator at Victoria Harbor, near Midland.

The Chatham, Wallaceburg & Lake Erie Electric Railway Co. will erect a large power house.

Drilling for oil will be recommenced by the Nova Scotia Oil & Gas Co., at Pansboro, N.S.

The Dominion Coal Co. will erect a modern plant for unloading coal vessels at Halifax, N.S.

The Winnipeg Electric Railway Co. is building a power house 70x180 feet and two storeys high.

R. Clohecy, architect, will build a brick house on MacNab street, Hamilton, to cost $1,300.

W. P. Bate, Saskatoon, will receive tenders for the erection of a new post office building there.

The Town of Sussex, N.B., has decided to erect a new school building at a cost of about $25,000.

The Intercolonial Railway are constructing a station and freight shed at McIntyre's Lake, N.S.

Guelph has voted to spend $55,000 to extend and improve the gas plant which is municipally owned.

The British Columbia Telephone Co., Victoria, will erect a three-storey central exchange building.

W. T. Williams has prepared plans for the erection of a new town hall at Medicine Hat, to cost $30,000.

The Canadian Westinghouse Co. have prepared plans for doubling the size of their foundry at Hamilton.

A $25,000 Baptist church will be built in Vancouver to take the place of the edifice destroyed by fire recently.

Building operations will commence at once on Cameron and Maudsley's new grist mill, at Gainsboro, Assa.

The Western Canada Flour Mills Co. have advertised for tenders for a six-storey mill structure at Winnipeg.

A new electric light and power plant will probably be erected at Collingwood, Ont., at a cost of about $35,000.

Messrs. T. E. Babbitt & Sons will

erect a large and modern saw mill at St. Marys near Fredericton, N.B.

Barnett & McQueen have been awarded the contract for the erection of the new Ogilvie flour mill at Fort William.

The Traders Bank are to erect a fine new branch bank on the northeast corner of King and Spadina, Toronto.

Guelph City Council has accepted the terms of the Fielding Chemical Co., which are proposing to locate there.

J. B. Rouse, Brantford, is contemplating the extension of his machine shop. He manufactures laundry machinery.

The York-Sunbury Milling Co., with saw mills at Gibson, N.B., will add a sash and door factory to their plant.

The John Cober Carriage Co., of Listowel, are talking of moving to Hespeler. They employ 20 to 30 men.

W. H. Ker, of the Brackman-Ker Milling Co., Vancouver, is to erect an $8,000 residence of the bungalow type.

W. L. Parish, Winnipeg, is building a block of stores and dwellings at Notre Dame and Gertie streets, in that city.

The Bank of Commerce is placing another branch near the corner of West Queen street and Dunn avenue, Toronto.

The Chatham Fanning Mill Co. will erect a solid stone and brick block at Brandon for office and warehouse purposes.

J. A. Gardiner, Barrington, N.S., is to establish a marine iron works at North Vancouver, alongside the Wallace shipyards.

The Bank of Toronto has secured the southwest corner of Bay and King streets, and will erect a new bank building there.

John Franski has secured the contract to build a cement block church for the Baptists of Emerson, Man., the cost to be $6,500.

The Town of Dauphin, Man., have voted favorably on a by-law to raise $35,000 for a fire hall and an electric light plant.

The Toronto & Niagara Power Co. are to build three power stations at Stoney Creek, Twenty-mile Creek, and Clarkson's, Ont.

The Temple Realty Syndicate, of Santa Rosa, Cal., will build a $25,000 store and office building on Pender street, Vancouver.

A syndicate of eastern capitalists are to erect a $25,000 business and residential block in Vancouver, to be called the Temple Building.

A company is being organized at Amherst, N.S., to establish a carriage factory. Stock amounting to $50,000 has been subscribed.

The Winnipeg gas plant is now in operation, the buildings having been built by the Manitoba Construction Co., at a cost of $140,000.

The Belleville Portland Cement concern is now running in full blast, and already a large number of good orders have been received.

W. O. and O. C. Hammant, Hamilton, have purchased a site for a factory to manufacture steel dump cars and cars for mining purposes.

The permit for the erection of the new Roman Catholic church, at Regina, has been granted. It calls for a building valued at $25.000.

The Cockshutt Plow Co. are building a fine warehouse at Regina. It will be of brick, three storeys high, and its dimensions 60 x 100 ft.

A large brass and iron pipe foundry to employ 100 men will probably be established at Fort William. Negotiations are now on for the site.

The Dominion Bridge Co. have decided to install a plant in Winnipeg to manufacture for their western business, and a site is being looked for.

The Grand River Metal Co., Galt, have amalgamated with the Canada Steel Goods Co., who are erecting a large factory at Hamilton.

The Canadian Steel Goods Co. are advertising for tenders for their cement and frame factory, to be erected on Arthur street, Hamilton.

J. H. G. Russell, architect, Winnipeg, is inviting tenders for the erection of a five-storey warehouse for Messrs. Scott, Bathgate & Co., that city.

J. Y. Griffin & Co., pork packers, etc., Winnipeg, are looking for a location in Fort William with a view to establishing a branch there.

James McDiarmid, Winnipeg, will shortly call for tenders for a new church building to cost $18,000, for the Point Douglas Presbyterians.

T. J. Fair & Co., Brantford, have taken out a building permit for their factory extension. The value of the extension is estimated at $2,800.

The Royal Canadian Flour Mills Co. will erect a million bushel elevator at St. Boniface, Man., and a mill with a capacity of 1,000 barrels daily.

The Dyment-Baker Lumber Co., London, has secured the buildings of the London Machine Tool Co., and will continue in business in that city.

The John Inglis Co., Toronto, have been awarded the contract for the installation of three new boilers at the water works at Brantford, Ont.

The Manitoba Iron Works Co., Winnipeg, have installed a complete electric lighting plant in the T. A. Garland Co.'s store, at Portage la Prairie.

The Dey-Manson Building & Construction Co. have been awarded the contract for the erection of a warehouse for the Moline Plow Co., at Winnipeg.

A large manufacturing industry in the United States are looking for a site at Toronto Junction. Negotiations are on for the old electric light premises.

E. G. Barrett, of the Vulcan Iron Works, Winnipeg, is spending a few days in Calgary investigating the situation, with a view of establishing a branch.

An electric power plant is to be established at Chignecto, about six miles from Amherst, N.S., to supply the factories in the latter town with power.

The new lumber mill at Terra Nova, N.S., for the Terra Nova Lumber Co., is now nearly completed, and is expected to be in working order by the 24th inst.

McKenzie & Mann are understood to be behind the new Canadian Northern Prairie Lands Co., which has been organized at Toronto, with a capital of $5,000,000.

Three weeks' work on M. J. O'Brien's mine at Cobalt is said to have produced 26 tons of metal averaging $2,000 to the ton. The district is being overrun with prospectors.

The Ingersoll Water Works Co will substitute electric for steam power at the pumping house, the current to be obtained from the Ingersoll Electric Light & Power Co.

Two large permits issued in Montreal are for a store on St. Catharine street, for E. P. Charlton, to cost $30,000, and for the Boys' Home on Mountain street, to cost $20,000.

The contract for the big storage reservoir to be constructed in connection with the Winnipeg waterworks has been let to the Toronto Contracting & Paving Co., for $69,771.

An American firm, manufacturing composite roofing, is to establish a branch at Brantford. An Ontario charter will be secured and the business conducted as a separate concern.

The Dennis Wire & Iron Co. have decided to remain in London and erect a larger factory, 72 x 160 feet, and two storeys high. Contracts for the new building have been let.

Several tests have been made at the works of the Sydney Cement Co., the results being considered very satisfactory. The company expects to be shipping cement in August.

The shipment of ore from the Vermilion range to the works of the Dominion Iron & Steel Co., at Sydney, N.S., has commenced and promises to be as large as in any previous year.

The congregation of the Montreal Annex Presbyterian Church are making preparations for the erection of a new church which will cost, with the land, in the neighborhood of $17,000.

The British Columbia Construction & Distribution Co. have been incorporated at Victoria, B.C., with a capital of $25,000, to produce electricity for light, heat, and power purposes, etc.

A new strike of excellent ore has been made at the Helen mine near Sault Ste. Marie. One thousand tons are being taken out daily and 30,000 tons have been shipped already this season.

The C.P.R. are considering the establishment of a smelter for the smelting of the cobalt and silver ore from New Ontario, which now goes to New York, and is thence forwarded to Saxony.

J. B. Dagainas, of Montreal, has completed the installation of the Pedlar Perfect Steel Lathing in the new Memorial Building which is being erected on Sherbrooke street of the same city.

The Board of Commissioners of the Temiskaming and Northern Ontario Railway Co. have decided to inaugurate a Government-owned telephone system for the entire length of their railway.

The Jenckes Machine Co., Sherbrooke, Que., have practically completed arrangements for the erection of branch factory buildings at St. Catharines, where 400 to 500 men will be employed.

The Canadian General Electric Co., Toronto, have supplied the machinery for the electric light plant now being installed at Bankhead, Alta., for the purpose of lighting that place and Banff, Alta.

The oil boom at Leamington, Ont., is over, and the industry is settling down to its real worth. The production runs nearly 20,000 barrels per month, and the large companies are buying all that is produced.

The ratepayers of Perth, Ont., have voted favorably on a by-law granting $25,000 to H. K. Wampole & Co., of Philadelphia, Pa., for the erection of a

factory for the manufacture of milk sugar, etc.

A power house will be erected in connection with the Canadian Pacific Railway Co.'s hotel now under construction at Victoria, B.C. An ice-making plant and a high pressure pumping plant will be installed.

Two hundred practical plate and sheet iron workers are to be brought to Canada from South Wales to work in the plant which is being established at Morrisburg by the Canadian Tin Plate and Sheet Steel Co.

Guelph is offering inducements to the Fielding Chemical Co., of Toronto, and they may locate in the Royal City in the premises formerly used by the Guelph Linseed Oil Co. Twenty men are to be employed.

The output of the collieries of the Crow's Nest Pass Coal Co. for the week ending June 23 totalled 11,972 tons, a daily average of 2,394 tons. All the mines were idle one day for the monthly holiday.

The Canadian-American Coal and Coke Co. at Frank, Alberta, are mining and shipping 400 tons of coal per day. Part of the mine is still closed on account of the recent fire. They intend opening it up again about July 15.

The Dominion Iron and Steel Co. have, in addition to the contract to supply 25,000 tons of steel rails to the Intercolonial, received an order from the Grand Trunk Pacific for 15,000 tons for the Fort William section.

F. R. Evans, architect, Winnipeg, will receive tenders for the erection of a five-storey warehouse for Messrs, Foley, Lock & Larson; also for the erection of a three-storey business block, 112 x 70 feet, for M. and L. Orris.

The Vancouver Construction Co. have secured a five years' contract for the supply of crushed rock to the City of Vancouver. The same firm are also constructing the new Canadian Pacific Railway wharves at Victoria, B.C.

Two of the four open hearth furnaces of the Nova Scotia Steel Co. at Sydney Mines were lighted last Saturday, and the first product of steel will likely be secured this week. For the present only ingot steel will be produced.

The Western Counties Electric Power Co., with headquarters in Hamilton, are negotiating with Brantford regarding the construction of a line to the latter city and the supplying of power for lighting and other purposes.

At a meeting of the directors of the Imperial Steel and Wire Co., Limited, of Collingwood, held recently, it was decided to double the capacity of the plant, bringing it to fifty tons minimum of finished wire products daily.

A company has been organized at Edmonton, N.W.T., with a capital of $100,000, to erect a flour mill with a capacity of 250 barrels daily. They are asking the town for a bonus and exemption from taxation for ten years.

The Fraser River Saw Mills Co. expect to have their large saw mills at New Westminster in operation shortly. A planing mill will be added to the Ross-McLaren property and the plant will be made thoroughly up-to-date.

The contract has been signed by Rupert H. Bradburn with the New York Theatrical Stock Exchange for the erection of a new $30,000 opera house at Peterboro, with a seating capacity of 1,500, to be completed by October 1.

The Truro Knitting Mills Co., Limited, are busy putting in new machinery. This week a large 80 horse-power boiler is being added to the power house and the company expect in the near future to increase the production 20 per cent.

The London Machine Tool Co. have decided to remain in London, having secured a splendid site of seventeen and a half acres just east of the city limits, and lying between the Grand Trunk Railway tracks and Trafalgar street.

The Western Canada Flour Mills Co. will erect a mammoth flour mill and elevator at Winnipeg or St. Boniface shortly. The company has purchased five elevators at Chater, Pendennis, Yorkton, Indian Head, and Crandall.

At Frank, Alberta, the Canadian-American Coal Co. have repaired the damage recently done to their mine by fire, and are now turning out 800 tons a day, and are preparing to sink a new slope to further develop their property.

The Town of Port Arthur, Ont., will build another dam on Current River, Engineer McDougall having reported that such a dam would give the town over double the storage capacity now obtained. The electric plant will also be increased.

The Molsons Bank have decided to build a fine structure on Bay street, just behind the Mail building, while the Canada Life Assurance Co. will extend their building to Bay street as soon as the Molsons Bank vacate their present premises.

Reduction works costing $700,000 are being erected at Frank, Alta., for the reduction of lead, silver-lead and zinc ores. British and Belgian capital is behind the enterprise. An output of 10,000 tons of lead per year is being prepared for.

The Town of Strathcona, Alta., are installing a 120,000 gallon steel tank, to be erected on an 80-foot steel tower, for their new water works system. The Ontario Wind Engine & Pump Co. supply the tank and tower, the cost being about $10,000.

The Canadian Pacific Railway Co. intend to erect large elevators at Victoria Harbor, their newly selected terminus on the great lakes, from which point there will be all-rail transportation to Montreal. The new route will save 150 miles of rail haulage compared with Owen Sound.

The Canada Bearings, Limited, Hamilton, will be in a position to make their taper roller bearings for vehicles and shafting by September. The company are now carrying on the general machine shop purchased from Chas. James recently.

The Climax Good Roads Machinery Co., Marathon, N.Y., has asked the council of Peterborough what inducements it could promise the company to establish works there. Besides road machinery, structural steel shapes would be manufactured.

A new industry has been established in Belleville, namely, the Dominion Bedding Co., which manufacture highest grades of bed springs and mattresses. Although but recently established, the firm is doing well, and employing a number of hands.

A large storage building for fire brick is being erected at Sydney, N.S., by Messrs. Falconer & Dixon. The same firm will shortly erect a building near the blast furnaces, to be used as a storehouse and repair shop for that portion of the works.

The Wm. Weld Co., Limited, and Mr. F. C. Bell, are to erect a $40,000 four-storey office building in Winnipeg, and the former company will likely instal a heating and power plant. The Weld Co. publishes the Farmers' Advocate, with head offices at London.

The Weber Co., Chicago, has charge of the construction of a steel concrete chimney for the new electric light station at Sydney, N.S. The chimney will be about 125 feet high and cost about $3,000. It is the first of its class to be erected in the lower provinces.

Williams & Wilson, Montreal, have purchased the premises now occupied by them on St. James street. The property has 85 ft. front and is 105 ft. deep, and is a central business stand. They propose at a later date to build on the unoccupied part of the property.

The Rhodes, Curry & Edmond Co., of Amherst and Sydn... purchased the plant of the Sydney Mfg. Co., and the franchises of that company to manufacture steel cars. The premises will be enlarged and the manufacture of steel and other railway cars commenced.

The Jenckes Machine Co. do not intend moving their main shops from Sherbrooke, Que., but will merely establish a branch in St. Catharines. The terms of the bonus granting the Jenckes Co. assistance by the City of Sherbrooke do not expire for fifteen years yet.

The contract for the complete forge shop equipment of the new manual training school of Washington University, St. Louis, Mo., has been awarded to the B. F. Sturtevant Co., of Boston, Mass. This consists of twenty down-draft forges with blast and exhaust fans

G. O. Buchanan, of Kaslo, Government inspector, estimates that the lead refined for the last fiscal year in British Columbia amounted to 17,000 tons, of which 11,000 tons were exported. Upon this quantity of refined the bounty, speaking roughly, would amount to $10,000.

A new vein of mica has been discovered near Carp, Ont., and the local people believe it may prove rich. A small quantity of this product has been taken out already in the vicinity but the mining operations were not pushed with sufficient energy to make the industry profitable.

An application has been made for the right to develop coal lands on the Porcupine River, Whitney Township, which is in New Ontario's famous clay belt. The parties who make the application are confident that a good quality of coal, in large quantities, is contained in the property.

Another epoch in the steel industry in Canada was marked on June 14, when the first rail passed safely through the new rail mill of the Dominion Iron and Steel Co., at Sydney, which has just been completed. The machinery worked to the entire satisfaction of the experts and other officials present.

The St. Lawrence Coal Co., who own

considerable coal properties at North Sydney, N.S., will shortly commence operations, and install a plant with a capacity of raising 500 tons of coal a day. Charles Brandeis, consulting engineer, Montreal, has been retained as chief engineer of the company.

The Dominion Copper Co. have acquired the Boundary Falls smelter, the Sunset, Morrison, Athelstan and Brooklin properties from the Montreal and Boston syndicate and it is said modern machinery and four blast furnaces and a converting plant to reduce matte to blister copper will be installed.

A wonderful discovery of gold is reported from Barrie Township, County of Frontenac. On June 10 the men employed by the Big Dipper Co., while prospecting, came upon the largest find in gold that has ever been discovered in Ontario. The quartz containing the gold will turn out $1,000 to the ton.

The erection of the dairy and science building, power house and principal's residence in connection with the Manitoba Agricultural College, will be proceeded with at once, the contract having been given to George A. Mitchell, of Winnipeg. The total cost of the contract is between $56,000 and $57,000.

The Robb Engineering Co., Amherst, N.S., have received an order from the Dominion Coal Co. for two 100 horsepower Robb-Mumford boilers; from the Standard Manufacturing Co., Sackville, N.B., for a 125 horse-power Robb-Mumford boiler, and from R. S. Carter, Maccan, N.S., for a 65 horse-power engine.

The Canadian General Electric Co., Toronto, are installing a new marble switchboard, with instruments and apparatus, necessary for 2,200 volt operation, and also an 800 gallon per minute turbine pump direct connected to an 80 h.p. induction motor in the Sudbury electric lighting plant and water works.

Among recent orders for marine generating sets taken by the B. F. Sturtevant Co., of Boston, Mass., are included those for F. B. Polson's and Timothy Eaton's private yachts, building at Toronto, Ont., for the tug "Menasket," and through the Portsmouth Navy Yard, for shops of the U.S. navy.

The report of General Superintendent Joseph Ripley, at St. Mary's Falls canal, shows that during May, 1905, 4,332,736 tons of iron ore passed through the American and Canadian locks at Sault Ste. Marie. Of this amount, 3,619,776 passed through the American locks and 712,960 through the Canadian locks.

The British Columbia Wire & Nail Co., Vancouver, B.C., have purchased 20 nail machines to make one-half to six-inch nails; also a drawing bench. The firm also bought a machine shop outfit and a staple machine. They are now erecting large factory buildings which will have a capacity for turning out 10 to 20 tons of nails per day.

The International Coal & Coke Co. are producing about 800 tons of coal a day at their mine at Coleman, in the Crow's Nest Pass region of British Columbia, and the main entry is now in the mountain for a distance of 4,000 feet. The coke ovens near the mine are producing 125 tons a day, which is taken by the smelters in the Northwest.

The hood is so designed with hinges and clips that the wheel may be readily removed or adjusted to fit the wheel as it wears to a smaller diameter. The outlet is connected to the exhaust fan, and a shield, a swivel plate and an extension slide may be adjusted so as to more fully enclose the wheel and prevent the discharge of particles into the room.

The Lloyd Mfg. Co., of Kentville, have recently shipped three carloads of saw mill machinery to Newfoundland, which, together with other large orders through correspondence, shows that their machinery is rapidly finding its way into new sections. Last year they shipped only a few machines; this year they report to have shipped six or eight carloads.

Operations have been resumed at the blooming mill of the Dominion Iron and Steel Co., at Sydney. The mill has been closed down on account of an explosion, the main engine blowing out the big cylinder head. But, notwithstanding this drawback, good progress is being made, and it is understood that all records as to the output of pig iron have been broken.

C.P.R. have decided to gradually replace all their main line wooden bridges with steel, along the Pacific division. A step in this direction has just been taken in the letting of contracts to the British Columbia General Contract Co. for the replacing of the wooden piers of the company's main line bridge across the Pitt River, with concrete piers. The contract price is $40,000.

The Geo. B. Meadows, Wire, Iron & Brass Works Co., Toronto, have purchased a site 140 x 90 feet on Wellington Place, corner of Draper street, on which they are erecting a new factory designed especially for their line of work. The factory will be 120 x 40 feet, four storeys high. This move has been made necessary by the expansion of the business.

The Crossen Car Mfg. Co., Cobourg, Ont., have orders on hand for 16 passenger cars of different descriptions for the Intercolonial Railway, one baggage and mail car and 200 box cars for the Temiskaming & Northern Ontario Railway; 10 passenger coaches, five baggage cars and 200 box cars for the Canadian Northern Railway; and 100 flat cars for the James Bay Railway.

The extension of the Pender Nail Works at St. John will be larger than the whole of the present plant. The addition will include a new machine room 48 x 40, a new wire mill 60 x 100 and a new cleaning house 46 x 78. Among other improvements the cleaning house will have an improved five-alley baker, which will have a number of improvements not found in other mills.

The Mundy Lumber Co., composed chiefly of Pennsylvania capitalists, will open its new lumber mill at Three Valley Lake, near Revelstoke, on July 1. The mill, which was installed by the Waterous Engine Co., is what is known as a double-cutting band mill, equipped with the latest details of machinery. It will have a capacity of about seventy thousand feet of lumber per day.

The report that the Nova Scotia Steel & Coal Co. were to remove their plant to Sydney Mines was mixed up with the closing of the furnace at Ferrona and the removal of the Trenton plant. The ore has all gone to Sydney Mines since last Fall and the ingots all go to Trenton for manipulation. Trenton is considered a better point for distributing the finished product than Sydney Mines.

G. H. H. Emett, of New Westminster, B.C., has brought out a new metal called "Emett's Hardite," for rock crusher jaws, shoes, dies, wire rope sheaves, and every place where hard metal is required. He is granting firms licenses to manufacture in different sections. Anybody wishing privileges will receive his attention. The metal has proved itself to be what he claims.

If the Dominion Coal Co. is to show as good shipments for 1905 as for 1903, some heavy hustling will require to be done the remaining months of the year. As compared with 1903 the shipments for the five months are nearly a quarter of a million tons short. That means if 1905 is to come up to 1903, the shipments for June, July and August, must average about 400,000 tons per month.

The managers of the Hamilton Bridge Co. have been notified that the company's tender for the steel work for the new Traders' Bank building, at Yonge and Colborne streets, has been accepted, and the contract awarded to the Hamilton concern. The Bridge Co. is under bond to have all of its work completed by December 1, and an immediate start will be made on the fourteen-storey building.

Contracts for complete heating and ventilating systems have recently been taken by the B. F. Sturtevant Co., of Boston, Mass., for the Fall River Iron Works Co., Dall River, Mass.; Nashua Mfg. Co., Nashua, N.H.; Bemis Bros. Bag Co., Kansas City, Mo.; Fore River Shipbuilding Co., Fore River, Mass.; Lewis A. Crossett, North Abbington, Mass.; and Trenton Brass & Machine Co., Trenton, N.J.

The assignment is announced of N. Thompson & Co., engineers, boilermakers, etc., of Vancouver. The firm of N. Thompson & Co. has consisted of N. Thompson, Wm. McCulloch and Andrew Muir, and has been brought conspicuous-

ly before the public during late years as promoters of the Vancouver dry dock in respect of which a substantial subsidy was voted them two years ago by the Federal Government.

The first shipment of steel rails was made by the Dominion Iron and Steel Co. on June 26, when about 50 tons were shipped to Montreal, being an instalment of the 25,000 ton contract for the Grand Trunk Pacific. Further shipments will be made from time to time, until the order is filled. The mill is now producing rails at the rate of 75 tons per hour. It is only about a week since it was put into commission.

Record shipment of heavy machinery is claimed for the speed with which a big steam shovel for the Northern Mines Co., Limited, of Spruce Creek, Atlin, traveled from Toledo, Ohio, to the coast. On June 2 it was shipped from Toledo, where it had been made to order. On June 19 it was in the C.P.R. yards here, and on the same day it was shipped on the steamer Amur, which luckily was in port bound north.

Extensive power development at Fort William is contemplated by a company with a capital of $2,000,000. They assume the name of Kakabeka Power Co., the incorporators being H. S. Holt, president Montreal Light, Heat & Power Co.; Charles R. Hosmer, a director of the Canadian Pacific Railway; F. W. Thompson, general manager and vice-president of Ogilvie Flour Mills Co.; W. Norton and F. H. Phippen, Montreal.

Captain J. A. Farquhar has proposed to the North Sydney, N.S., city council to build a railway dry dock, at that place, at a cost of $250,000, if a bonus of $2,500 a year for 20 years with free water and exemption from taxes are granted him. He is also interesting the Government with a view to obtaining a subsidy for a complete modern wrecking plant, to be established at North Sydney. This would cost about $140,000 additional.

The site of the blast furnace and coal docks at Port Arthur has been changed, and the works will be located three-quarters of a mile closer to the town, near the Canadian Northern roundhouse. It was found that the bottom at the first site was not suitable for a foundation, and the companies decided to change the site. The new site will greatly benefit Port Arthur. Barnet & Ricord are moving their plant to the site to-day.

The total production of steel ingots and castings in Canada in 1904 was 148,784 gross tons, against 181,514 tons in 1903, a decrease of 32,730 tons. Bessemer and open-hearth steel ingots and castings were made in each year. Almost all the open-hearth steel reported in 1903 and 1904 was made by the basic process. The direct steel castings made in 1904 amounted to 6,505 tons. Canada has not made crucible steel prior to the present year.

The Manitoba Iron Works, Limited, of Winnipeg, have been awarded the contract for the two 66-inch boilers, as well as the 250,000-gallon steel water tower for the new Portage la Prairie waterworks, and all the cast iron work for the manhole and valve covers for the sewer system. This company has just installed $5,000 worth of bolt-making machinery in their plant, and are turning out a large quantity of bridge and other heavy structural iron work.

The Canadian General Electric Co. will get a large quantity of work out of the conversion of steam power plants into electric power plants in Toronto. As soon as the Niagara power is turned on the construction of the new electric railway to Niagara will be started. In the construction of this line and in the conversion of power plants there will be from $2,500,000 to $3,000,000 of work, the bulk of which will go to the Canadian General Electric Co.

The concrete foundation for the large new warehouses of the Massey-Harris Co., Limited, Toronto, is now nearly completed for the first section. A drain is run along the bottom of the foundation on the outside, necessitating that for the holding of the concrete the foundation be boarded up from both sides. The building is to be heavy mill construction, the walls being of brick. The work is being done by the Massey-Harris Co. themselves by day labor.

A permit has been issued for the erection of a $122,000 apartment house at 355 Mountain street, Montreal. The building will be four storeys high, constructed of stone and brick, and will accommodate thirty-two families. It will have fireproof walls, elevators and a cold storage equipment, and three water mains, each of four inches' diameter, will supply it with fire protection. The building will be 147x179 feet, and will stand fourteen feet back from the street.

Engineers engaged on the surveys for the Grand Trunk Pacific Railway are reported to have made a rich discovery of oil just east of Lake Abittibi, in the farther Temiskaming district. A huge well pouring forth quantities of oil, estimated at 700 barrels a day, has been located, and it is evident that the flow has been going on for years. The constant flow has resulted in the formation of a lake of oil. The oil field is located on land belonging to the Province of Quebec.

The amazing variety which exists in the applications of hot blast drying apparatus is exemplified by recent installations made by the B. F. Sturtevant Co., of Boston, Mass. Among these are comprised installations for drying hops in the Sacramento Valley, lumber in Iowa, cloth in North Carolina, brick in Georgia, gun powder in New Jersey, lace curtains and handkerchiefs in Illinois, fish fertilizer in New York, rubber in Massachusetts, artificial leather in New Jersey and plaster in New York.

It is a fact which is perhaps scarcely realized, that one-third of the production of silver in the United States is derived as a by-product from the smelting of copper ores, the larger part of which do not contain enough silver to be classed as paying silver ores. It is estimated that 18,600,000 ounces of silver were obtained in 1904 from the copper ores of the United States. By far the largest amount was supplied by Montana, and nearly the whole of this was derived from the Butte copper ores.

The Ontario Government has accepted the resignation of Mr. N. W. Rowell as the Province's agent on the board of directors of the Consolidated Lake Superior Co., and has recommended Mr. William H. Plummer, merchant, of Sault Ste. Marie, as a director of the company, and designated Mr. W. H. Hearst, of Sault Ste. Marie, as the Government's agent. The position held by Mr. Rowell is thus divided. Mr. Plummer is the brother of Mr. J. H. Plummer of the Dominion Iron and Steel Co.

In May the Granby Co. treated 55,420 tons of ore and 242,124 tons for the for May would indicate net earnings of between $70,000 and $75,000. The Granby Co. recover about 26 lbs. of copper per ton of ore, and, crediting the gold and silver values against copper costs, the company are securing a net profit of about 5 cents per pound, with 15 per cent. copper. The company will shortly blow in two large furnaces which will materially increase both production and profits.

It took two years to find or secure a block of stone large enough to top the mausoleum of a California millionaire, but the order has been filled at last from the Newcastle quarries, Vancouver Island. The piece of stone is $14\frac{1}{4}$ ft. x $8\frac{3}{4}$ x $2\frac{1}{2}$ ft. and weighs $17\frac{1}{2}$ tons. A fifty-ton crane has been set up to lift the stone, which is to be shipped at once. Thirty years ago the stone for the San Francisco mint was taken from these quarries, which have been idle nearly ever since. They have now been re-opened.

A handsome and magnificent structure, costing in the neighborhood of $500,000, for the Credit Foncier Franco-Canadien, will shortly be erected at the corner of St. Lambert Hill and St. James street, Montreal. The new building will contain a hundred and twenty-six offices besides the Credit Foncier's own quarters, and will be ten storeys in height, extending upward 132 feet to the heavy-cut cornices above. The offices are to be ventilated by a fan system, the tempered air thus secured being regulated automatically.

A Sydney despatch says the steel plant of the Nova Scotia Coal and Steel Co. at Sydney Mines is now assuming practical shape. The gas producers for the open-hearth furnaces are already fired preparatory to heating the furnaces. The plant will commence work during the first week in July. The building containing the open-hearth plant alone cost $78,000, while each furnace was constructed at a cost of $100,000. The company's blast furnace is turning out an excellent product, its capacity reaching maximum output.

Contracts for the extension of the Pender Nail Works at St. John, N.B., have been awarded. The addition will be larger than the whole of the present works. The addition will include a new machine room 48x40, a new wire mill 60x100, and a new cleaning house 16x78. The latter will have a new and improved cleaning pit, inclosed with brick and cement walls, and having a concrete floor. The cleaning house will also contain an improved five-alley baker, which will have a number of improvements not found in other mills.

A group of claims of specular hematite iron ore is located at Crawford Bay on the north arm of Kootenay Lake, about 25 miles from Nelson, B.C. The owners have entered upon the development of this deposit, and it is expected that they will soon be manufacturing pig iron upon a large scale. It is said that adjoining the iron ore there is a large deposit of limestone needed for a flux in smelting iron ores. Both deposits are said to be practically unlimited, and the iron ore is the finest yet discovered in the eastern portion of the province.

A particularly promising discovery of

copper has recently been made in Awenge Township, ten miles from the Soo, on the line of the Algoma Central Railway. A syndicate of residents of the two Soos have a vein of 500 feet uncovered, which shows throughout its whole length ore rich in copper and silver, as well as to the bottom of a shaft that has been sunk to a depth of thirteen feet. The average rock shows an assay of $37.98 per ton, while picked samples run as high as 30 per cent. copper. The company will immediately sink a shaft to a depth of 150 feet and then drift.

The Cape Breton Coal, Iron and Railway Co. are seeking concession from the City of Sydney with a view of establishing in Canada a branch of the Armstrong Arms Works, of England, shipping piers for their Broughton collieries, and other works, involving a $20,000,000 expenditure. Besides exemption from taxation and water privileges, they ask for the transfer to them of Victoria Park, and Imperial Government property on harbor front. Most of the directors of the company are also directors of the Armstrong works.

The Hamilton Bridge Works, Hamilton, have the contract for the steel construction of the Traders' Bank Building, Yonge street, Toronto. Seventeen hundred tons of steel are to be used in the building. The contract calls for the completion of the steel work by Dec. 1.

The Waterous Engine Works, Brantford, have just completed four 1,200-gallon fire engines, two for Toronto and two for Winnipeg. They are working just now on fire engines for Vancouver, Montreal and Cunegogue, Que.; they are also working on a saw mill outfit for foreign shipment.

The Canadian Coal & Ore Dock Co. will build a combined coal and ore dock at Port Arthur, Ont. The first section, to be 3,000 by 600 feet, will be completed this year. It is proposed to dredge a channel, about 200 feet wide and 3,000 feet in length, from the harbor, which will cross the end of the dock, and to divert into it the waters of the creek and river. The dock will be open to the public and all coal dealers will be permitted to use it, a fixed tariff being arranged for handling and storage. The Barnett & Record Co., Minneapolis, Minn., are the contractors.

The City of Vancouver has too many skilled artisans in various branches of the building trade, say the Trades and Labor Council. This body has sent a circular to the Toronto Trades and Labor Council. The action is asserted to be as an offset to advertisements alleged to have been put in eastern papers by certain Vancouver employers who wish to see wages reduced. The labor men say that many men are out of work, because of the influx of newcomers. At Labor Hall many of these new arrivals inquire for work, and all seem to have a wrong impression as to the demand for men.

Thomas Drummond, vice-president of the Lake Superior Corporation, states that the report of the re-opening of the car shops at Sault Ste. Marie is premature. As a matter of fact, the shops which have a capacity of eight finished freight cars per day are ready to open at any time that sufficient business offers, but there is at present no work for them. Speaking of the rail mill, Mr. Drummond says that they are now turning out considerably upward of 500 tons per day, which are all contracted for. The total rail output since the mills opened amounts to 100,000 tons.

The second of the three power development companies at Niagara Falls is now ready for business. On July 1 and 2 the Ontario Power Co. had a section of its power house running and turned power on a transmission line. The water was let into the great mile-long steel and concrete conduit from the head gates, ran down to the table rock, plunged down through the penstocks a hundred and fifty feet, set the ten-thousand horse-power turbines spinning and escaped into the river again. Not a hitch or a delay occurred. Every bit of the ponderous machinery moved like the works of a watch.

A patent controlled by the B. F. Sturtevant Co., of Boston, Mass., has just been issued for a special type of exhaust hood for grinding and polishing wheels. Its special feature consists of a receptacle to catch the particles of solid matter passing from the wheel. The suction being controlled so that it is not quite sufficient to draw them away, these particles fall to the bottom and are there collected, while the practically free air passes through a collector where the last vestige of dust is removed. The receptacle can be readily emptied when it becomes filled, and its use avoids excessive wear on the exhaust fan, piping and collector.

The James Warnock Co., Limited, Galt, Ont., have recently acquired the business of James Warnock & Co. and will continue in a much larger way the manufacture of edge tools and lumbering tools in which Messrs. James Warnock & Co. have acquired so wide and enviable a reputation. The new company have just disposed of their spring business and will replace their spring plant with a new and entirely modern edge tool and lumbering tool plant. Within six months the James Warnock Co., Limited, will be in a position to supply their numerous customers with tools of the highest possible grade in any quantities they desire.

Mining operations in the County of Hastings are at present very active. The Craig Gold Mine, near Bannockburn, is doing well. Some fifty men are employed there. The Star of the East Mine, near Cloyne, is being developed with good results. The main shaft is sunk 180 feet into the rock, and there are three drifts from this shaft. At present a ten-stamp mill is in operation, which is continually kept busy. The Golden Fleece Mine, situated near Flinton, has recently been secured by a Mr. Cowan, who is developing it, and claims that it is rich in mineral deposits, but the working conditions are not so economical as upon other properties.

The troubles of the miners of Nanaimo, in which the whole business interests of the coal city are involved, remain in an unsettled state yet, as the miners have turned down, by overwhelming majority, the company's proposal of compromise. It is said that the present difference between the men and the company does not amount to more than three or four cents per ton on the cost of mining the coal. The business situation in Nanaimo is very correctly described as critical. The past two weeks over 800 men have left the place, most of them coming to Vancouver and proceeding up-country to seek work on the new C.P.R. short line being built from Spence's Bridge to Nicola Lake.

Judge Reynolds, Brockville, has given an important decision on a clause of the new Assessment Act. The new Act says that machinery shall be assessed as part of the real estate, but exempts fixed machinery used for manufacturing purposes. James Cummings, of Lyn, who owns a large mill property, appealed against his business assessment, which is based on the real estate value, the assessors having placed the machinery as part of the real estate. The judge decided that fixed machinery meant any machinery being permanently used for manufacturing purposes, and consequently his milling machinery was exempt. This judgment is very important to manufacturers.

The Eckardt Casket Co. and the Eckardt Silver Plate Co., one of the enterprises burned out in the great fire, in Toronto, announced that they were about to remove from the city and establish factories outside. At that time it was stated that Brampton would be the lucky town. Since then, however, the firms have reconsidered their decision and will rebuild in Toronto. The announcement of the firms' intention of removing brought them in a host of offers of free sites, tax exemptions, free water and light, and other bonuses from hustling outside towns. Among the towns that negotiated for the new factories were Barrie, Brampton, Galt, Stratford and Trenton.

A manufacturing plant which would revolutionize the iron foundry business on the coast may be located in Vancouver if it is found that the possible business would warrant the investment. The plant would be one for the conversion of common iron castings into steel. For instance, an ordinary cast iron gear wheel or a pulley can be turned into steel by an already well-tested and practical process as easily as cream is turned into cheese. The possibilities of the process are practically illimitable. It is stated that ordinary cast iron can even be converted into tool steel that will take a temper superior even to that of Jessop's best. The promoters of the Ottawa Steel Castings Co. are said to be behind the move in Vancouver.

Another record in the line of cargoes on the great lakes was established when the steamer Elbert H. Gary, of the Pittsburg Steamship Co., the largest boat in commission on fresh water, passed through the Canadian Soo canal, carrying the largest load of iron ore ever taken down the great lakes. The Gary, which is 569 feet in length, had on board 11,424 tons of ore, but although she thus broke one record and established another the fact excites little more than passing comment, as the commerce of the lakes is growing so fast that such feats are being accomplished several times each year. While the Gary now holds the records, there are other boats in course of construction on shipyard docks of the lakes that will carry much larger cargoes than she is capable of.

The Eckardt Casket Co. and Eckardt Silver Plate Co. have secured factory buildings at Niagara and Tecumseth streets, Toronto, their purchase of the site forcing eleven other firms to move. These are: The Palmer Piano Co., Mason & Risch Piano Co., United Elec-

tric Co., Barthelmes Piano Action Co., W. Bohn & Co., piano key manufacturers; Spence & Co., Gilchrist & Co., contractors; Colleran Mattress Co., Toronto Woodmaking Co., Carlyle Mfg. Co., and American Autoharp Co. There is 400 horse-power capacity twin engine, 800 lb. boiler capacity, and 125,000 feet capacity for dry kiln. There are five railway switches on the premises, one runs into the main building direct over to the planing mill and dry kiln, two in the yards to pile lumber on both sides, and one into the coal bin.

The crude method of ventilating by means of a heated air shaft, which once served fairly well to meet the needs in shallow mines of small extent, is absolutely incapable of fulfilling the requirements where the workings are deep and extended and the passages are frequently miles in length. With the estension of the workings came a demand for more positive means, which was met by the substitution of the fan blower or exhauster; first known to have been applied for the purpose in the fifteenth century. From the simplest device operated by hand, improvement was slow indeed, until the advent of the steam engine. But to-day no greater refinements in fan design are to be found than in the modern mine ventilating equipment, without which mine working would in many cases be impossible.

The building of the Michigan Central Railway's double tunnel under the Detroit River will provide an immense amount of work for a big foundry plant. The tunnel will cost upwards of ten million dollars, and it is likely that a foundry plant costing half a million dollars would be a profitable investment. As the tunnel is to be constructed from the Windsor end right to the Detroit terminal before anything is disturbed on that side, it is quite possible that the foundry may be located at Windsor to avoid the heavy duties which will have to be paid on the material if imported from the United States. It is definitely announced that work will begin upon the tunnel by October 1. There are many legal preliminaries to be settled first. By the time the tunnel is completed the Michigan Central will have a double track from Chicago to Buffalo.

It is said that the largest steel flume ever built is at Niagara Falls, on the Canadian side of the river, where the Ontario Power Company has secured rights for the development of 180,000 h.p. The flume in question has a length of 6,180 feet. Its inside diameter is 18 feet, and it will divert 3,900 cubic feet of water from the river above the Horseshoe Falls every second. This flume is so large that it was necessary to establish a temporary shop on the grounds for its construction. It runs through Victoria Park, and is laid in a trench. In order that it may not mar the beauty of the park lands, the great pipe is covered with earth, but before being so concealed was given a jacket of concrete so that there would be no unequal pressure of the earth. The flume is protected against electrolysis. From the water that will flow through this pipe it is expected to develop 60,000 electrical horse-power. Three such flumes will be constructed.

Since the beginning of the year the Helen mine has steadily increased its output till its average output is now 5,000 tons a day and the activity at this mine and others in the Michipicoten district has supplied quite a large amount of traffic for the Algoma Central Railway. With so much business offering the staffs at the different plants have been largely increased, and the increased population in the two towns has meant abundant traffic for the car systems in the two towns as well as for the ferry service between the towns. Then the figures will show that the Lake Superior Corporation is now without any outstanding indebtedness and is regularly paying the interest on all its bonds. At the close of the first regular fiscal year the different subsidiary companies will certainly be in a much better position than the most sanguine directors had hoped for. Without the $2,000,000 loan made by the late Ontario Government it is doubtful whether the works would be running at all.

The business the Toronto architect's office is doing in building permits this year does not indicate any letting up in building activity. In fact, the returns for the first six months of the year indicate a greater boom than ever. The following comparative table shows the situation at a glance.

	1904.	1905.
Jan. 1st to June 30th	$2,625,883	$4,494,326
June	1,100,820	1,303,208
Permits. 6 mos.....	922	1,290
Permits in June...	217	376
Buildings erected, 6 mos	743	1,535

In Montreal in June the value of new buildings totalled $396,943, with 124 permits issued. Last year, in June, there was a value of $373,827 and only 84 permits.

There was a total value of alterations and new buildings of $471,143, as against $419,285 for June, 1904, a difference of $51,858.

A mass meeting of the leading Chinese merchants in Vancouver, B.C., assembled under the auspices of their Board of Trade recently, and declared a boycott on U. S. goods. Eight hundred Chinamen listened to strong speeches criticizing the insolence with which immigration officials of the United States treat distinguished natives from China, visiting the Republic. The sum of $1,000 was subscribed on the spot to be forwarded to the merchants of Shanghai, the receipt of whose circular to all Chinese bodies abroad was the cause of the meeting being held. Money will be used to pay Chinese coolies for refusal to work at cargoes on ships containing U. S. goods. The difference in the treatment received in Canada was pointed out and all pledged themselves to buy Canadian goods in preference to American. There are many thousands of Chinese resident in Vancouver and this will make a considerable difference to Canadian man facturers.

When the members of the Canadian Electrical Association visited the Allis-Chalmers-Bullock, Limited, works at Rockfield, they were shown under construction one of the two 750 h.p. induction motor generator sets for the Montreal Street Railway two 600 k.w. alternating current water wheel pipe generators for the Souther Light & Power Co., Toronto, and two of four 75 k.w. direct current engine pipe generators for the C.P.R. Hotel in Winnipeg. At the Shawinigan Water & Power Co. substation at Maisonneuve, they also inspected an 8,000 h.p. frequency changer, five 1,200 h.p. frequency changers, two 900 k.w. three-face transformers and two 800 k.w. rotary converters, all of which were installed by the Allis-Chalmers-Bullock, Limited. Special attention was paid to the 8,000 h.p. frequency changer, for it is not only the largest frequency changer every built, but is composed of the largest alternating current generator in operation at the present time, viz., 5,750 k.w., and the largest electric motor ever built, viz., 8,000 h.p.

A Neat Installation.

A power plant for the new Bank of Montreal Building at Montreal, has recently been completed, and is one of the most up-to-date to be found anywhere. The plant supplies heat, light and ventilation for the new structure. Machinery equipment in the powerhouse includes two Williams compound engines, each to give 100 brake horse-power when running at 460 r.p.m. with a steam pressure of 120 lbs. per square inch at the stop valve when non-condensing. These are connected to two Westinghouse direct-current, compound-wound, engine-type generators, 125 volts, placed on extended engine shafts.

Confusion About Steel Companies.

There appears to be some misunderstanding throughout Ontario concerning the two steel companies, the Canadian Drawn Steel Co., Hamilton, and the Union Drawn Steel Co., Hamilton. They are two distinct companies.

The Canadian Drawn Steel Co. are a purely Canadian enterprise, the capital being Hamilton capital. They are at present building a plant in Hamilton, and already machinery is arriving upon the spot. They expect to be ready to manufacture by September.

The Union Drawn Steel Co., Hamilton, are a branch of the Union Drawn Steel Co., Beaver Falls, Pa., U.S.A. At present they are occupying a building in Hamilton formerly used for a skating rink.

Pneumatic Tool Deal.

Tariff duties have again influenced a large business deal of great interest to Canada. This time it has caused the Canadian Pneumatic Tool Co. to be purchased outright by the Chicago Pneumatic Tool Co., Limited. The Canadian Pneumatic Tool Co. has been carried on for some time in Montreal under the direction of N. J. Holden & Co., and they were carrying on a large business which had steadily grown since its inception. On the other hand, the Chicago concern has been hampered in its work in Canada by the onerous customs duty which was levied upon its goods. The purchase of the Canadian company's capital stock was consummated some days ago, and the full possession will be made in the course of this month. The amount of money involved has been exaggerated in the papers owing to the dispatches from New York, which quoted $600,000 as the sum. The correct sum as stated by Mr. Holden, the president and general manager here, should read $60,000. He also stated that there would merely be an enlargement of the business formerly carried on inasmuch as all tools sold would be manufactured here, and that the same management would be retained

as was formerly embraced in the Canadian company.

The news was first given out at the annual meeting of the Chicago company, which was held at New York last week. The Chicago Pneumatic Tool Co. has recently been branching out in their own country, for it is only a short time ago that they purchased control of the Philadelphia Pneumatic Tool Co. and the Chicago Storage Battery Co.

PERSONAL MENTION.

Mr. H. L. De Wolfe, formerly manager of the Vincent Value Co., of Boston, is now connected with the Canadian Fairbanks Co., Limited, as manager of their valve and steam specialty department, and will be located in Montreal.

Mr. J. S. Larke, Canada's trade commissioner in Australia, arrived at Vancouver on Wednesday, July 12th, being his first return to this country since his appointment ten years ago. During Mr. Larke's regime Canada's trade with Australia has increased enormously.

Mr. S. Edwin Taylor, of Wellington, New Zealand, who has large mining interests in that country, has been spending a few weeks at his native town, Peterboro, which he left forty years ago to seek his fortune in another land. This was his first trip home in that time. He has some interesting reminiscences of this country as it was then. He expressed his delight at the wonderful strides this country had made.

Mr. E. C. Reeder, mining engineer, who has just been appointed representative of Allis-Chalmers-Bullock, Limited, at Nelson, B.C., is a native of Michigan, and received his education in the public schools of that State. He graduated later from Michigan College of Mines as mining engineer, and supplemented his college work with courses at the Massachusetts Institute of Technology. He had several years' practical experience in Montana after graduating, where he worked as a miner and smelter man in the mines and smelters at Butte. Later he went to Utah, where he held responsible positions as foreman and engineer for several of the large mining and smelting companies of that city.

A New General Manager.

New energy and strength has been given to the Canada Machinery Co., Limited, Sarnia, by the addition to the personnel of the concern of W. F. McGuire, who takes the position of vice-president and general manager.

Mr. McGuire is a thoroughly experienced machinery man, having behind him many years of connection with the largest firms in the United States. He brings to his new duties, in addition to considerable capital, great aggressiveness, as well as new mechanical ideas, one result of which is that the company have already decided to place on the market several new machines. Several improvements on their existing lines are to be made.

To assist in the promulgation of his ideas, Mr. McGuire has brought with him an expert mechanical engineer and designer, who has had experience particularly in designing automatic tools for railway shops and large machinery uses.

These gentlemen have looked into the machinery situation in Canada thoroughly, and have decided to throw in their lot with the Canada Machinery Co., which should now be an even stronger factor in the machinery business than heretofore. Especial attention will be devoted to the construction of high-speed tools, the end being to reduce the cost of manufacture.

The Canada Machinery Co. have added to the already well-equipped plant formerly owned by the G. A. Crosby Co., Point Edward, near Sarnia, several large tools, and are now in a position to build anything in machine tools.

CANADIAN WHITE CO., LIMITED.

THE announcement has recently been made of the incorporation in Canada of the Canadian White Co., Limited, to carry on a general contracting and engineering business on similar lines to J. G. White & Co., Inc., of New York; J. G. White & Co., Limited, London, Eng., and the Waring-White Building Co., Limited, London, Eng. The letters patent of the Canadian company were granted the latter part of May, and the organization of the company is being completed. The object of the company will be to carry on a general contracting and engineering business, and undertake any civil, mechanical, electrical, hydraulic building work. This company will have at its service the New York and English companies.

The board and stock holders of this company are strong representative business men, well known in Canada. The treasurer is Mr. H. P. Douglas, formerly vice-president and general manager of the Canadian Otis Elevator Co., Limited, and Mr. H. C. Hitch, who was for several years superintendent with the Thompson-Starrett Co., of New York, will be superintendent of building construction, while a prominent civil manager. A large engineering staff has been engaged, so that the company is now in a position to undertake the building of any class of large structural work.

CONDENSED MACHINERY ADVERTISEMENTS.

Advertisements under this heading, 2c. a word first insertion; 1c. a word each subsequent insertion.

Contractions count as one word, but five figures (as $1,000) are allowed as one word.

Cash remittance to cover cost **must** accompany all advertisements. **In no case** can this rule be overlooked. Advertisements received without remittance cannot be acknowledged.

Where replies come to our care to be forwarded, five cents must be added to cost to cover postage, etc.

MACHINERY BUYERS' DIRECTORY.

Abrasive Materials.
Canada Machinery Agency, Montreal.
The Canada Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Air Brakes.
Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Air Receivers.
Chicago Pneumatic Tool Co., Chicago.

Arc Lamps.
Canadian General Electric Co., Toronto.
The United Electric Co., Toronto.

Augers.
Chicago Pneumatic Tool Co., Chicago.

Axle Cutter.
A. B. Jardine & Co., Hespeler, Ont.

Axle Setter and Straightener
A. B. Jardine & Co., Hespeler, Ont.

Babbit Metal.
Canada Metal Co., Toronto

Barrels, Tumbling.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.
Niles-Bement-Pond Co., New York.

Batteries, Storage.
Chicago Pneumatic Tool Co., Chicago.

Bell Ringers.
Chicago Pneumatic Tool Co., Chicago.

Belting, Leather.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.
Williams & Wilson, Montreal.

Belting, Cotton.
Dominion Belting Co., Hamilton.
Sadler & Haworth, Montreal.

Belting Supplies.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.
John Bertram & Sons Co., Dundas, Ont.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Benders, Tire.
A. B. Jardine & Co., Hespeler, Ont.

Blowers.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Boilers.
Goldie & McCulloch Co., Galt.
Owen Sound Iron Works Co., Owen Sound.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Boiler Compounds.
Canada Chemical Mfg. Co., London, Ont.

Bolt Cutters.
National Machinery Co., Tiffin, Ohio.

Bolt and Nut Machinery.
A. B. Jardine & Co., Hespeler, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Books, Mechanical.
Technical Pub. Co., Manchester.
The MacLean Pub. Co., Ltd., Toronto.

Boring and Drilling Machines.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.

Boring Machine, Upright.
John Bertram & Sons Co., Dundas, Ont.

Boring Machines, Wood.
Chicago Pneumatic Tool Co., Chicago.

Boring and Turning Mills.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Box Puller.
A. B. Jardine & Co., Hespeler, Ont.

Bulldozers.
John Bertram & Sons Co., Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Cabinets, Tool.
Armstrong Bros. Tool Co., Chicago.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
Rice Lewis & Son, Toronto.

Castings, Grey Iron.
F. L. Hare, Oshawa, Ont.

Castings, Brass.
F. L. Hare, Oshawa, Ont.

Calipers.
L. S. Starrett & Co., Athol, Mass.
Rice Lewis & Son, Toronto.
Williams & Wilson, Montreal.

Centering Machines.
John Bertram & Sons Co., Dundas, Ont.
Pratt & Whitney Co., Hartford, Conn.

Centres, Planer.
Pratt & Whitney Co., Hartford, Conn.

Chucks, Ring Grinding.
A. B. Jardine & Co., Hespeler, Ont.
Chicago Pneumatic Tool Co., Chicago

Chucks, Drill and Lathe.
John Bertram & Sons Co., Dundas, Ont.
Ker & Goodwin, Brantford.
King & Crosby, Hamilton.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Chucks, Planer.
Francis Reed Co., Worcester, Mass.

Chucking Machines.
American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Potter & Johnston Mach. Co., Pawtucket, R.I.

Circuit Breakers.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Clippers, Bolt.
A. B. Jardine & Co., Hespeler, Ont.

Compressors, Air.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Consulting Engineers.
Canadian White Co., Montreal.
Charles Brandeis, Montreal.
John S. Fielding, Toronto.
Roderick J. Parke, Toronto.
T. Pringle & Son, Montreal.

Contractors.
Canadian White Co., Montreal.

Controllers and Starters, Electric Motor.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock Co., Montreal.

Coping Machines.
John Bertram & Sons Co., Dundas, Ont.

Cotton Belting.
Sadler & Haworth, Montreal.

Cupola Blowers.
Sheldon & Sheldon, Galt, Ont.

Cutters, Flue.
Chicago Pneumatic Tool Co., Chicago.

Cutters, Milling.
Becker, Brainard Milling Machine Co., Hyde Park, Mass.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Machines.
John Bertram & Sons Co., Dundas, Ont.
Hurlbut-Rogers Machine Co., South Sudbury, Mass.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Tools.
Armstrong Bros. Tool Co., Chicago.
H. W. Petrie, Toronto.
Mechanics' Supply Co., Quebec.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Dies, Opening.
W. H. Banfield & Sons, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.
W. H. Banfield & Sons, Toronto.
The Globe Machine and Stamping Co., Cleveland, Ohio.

Dies, Threading.
W. H. Banfield & Sons, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Drawing Instruments.
Mechanics' Supply Co., Quebec.

Drawn Steel, Cold.
Canadian Drawn Steel Co., Hamilton.

Drills, Bench.
B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
King & Crosby, Hamilton.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.
Francis Reed Co., Worcester, Mass.

Drills, Blacksmith.
Francis Reed Co., Worcester, Mass.

Drills, Centre.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.
L. S. Starrett Co., Athol, Mass.

Drills, Chucks.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Clamp.
Francis Reed Co., Worcester, Mass.

Drills Electric.
Chicago Pneumatic Tool Co., Chicago.

Drills, Hand.
A. B. Jardine & Co., Hespeler, Ont.

Drills, High Speed.
Wm. Abbott, Montreal.
Pratt & Whitney Co., Hartford, Conn.

Drills, Horizontal.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.

Drills, Pneumatic.
Chicago Pneumatic Tool Co., Chicago.

Drills, Ratchet.
A. B. Jardine & Co., Hespeler, Ont.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.

Drills, Rock.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.
Francis Reed Co., Worcester, Mass.

Drills, Shop View.
John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.
Chicago Pneumatic Tool Co., Chicago.
A. B. Jardine & Co., Hespeler, Ont.

Drilling Machines, Arch Bar
John Bertram & Sons Co., Dundas, Ont.

Drilling Machines, Boiler.
American Tool Works Co., Cincinnati.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Connecting Rod.
John Bertram & Sons Co., Dundas, Ont.

Drilling Machines, Locomotive Frame.
John Bertram & Sons Co., Dundas, Ont.

Drilling Machines, Multiple Spindle.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill & Tool Co., Cincinnati.
Canada Machinery Agency, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Pneumatic.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drilling Machines, Portable.
A. B. Jardine & Co., Hespeler, Ont.

Drilling Machines, Radial.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Bickford Tool & Drill Co., Cincinnati.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Suspension.
John Bertram & Sons Co., Dundas, Ont.

Drilling Machines, Upright.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
King & Crosby, Hamilton.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Vertical.
John Bertram & Sons Co., Dundas, Ont.

Drop Forging Dies.
The Globe Machine and Stamping Co., Cleveland, Ohio.

Drying Apparatus of all Kinds.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dust Separators.
Sheldon & Sheldon, Galt, Ont.

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Electrical Construction Co., London, Ont.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
United Electric Co., Toronto.
Volta Electric Repair Works, Toronto.

Electrical Supplies.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London, Ont.
Packard Electric Co., St. Catharines.
The United Electric Co., Toronto.
Volta Electric Repair Works, Toronto.

Electrically-Driven Tools and Machinery.
Allis-Chalmers-Bullock, Montreal.
American Tool Works Co., Cincinnati.
Canada Machinery Agency, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Electrical Repairs.
Volta Electric Repair Works, Toronto.

Emery Wheel Dressers.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.

Engineers' Supplies.
Mechanics' Supply Co., Quebec.
Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Engines, Steam.
Allis-Chalmers-Bullock, Montreal.
The Goldie & McCulloch Co., Galt, Ont.
E. Leonard & Sons, London.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Exhaust Heads.
Sheldon & Sheldon, Galt, Ont.

Expanded Metal.
Expanded Metal and Fireproofing Co., Toronto.

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A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

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S. Vessot & Co., Toronto.

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Rice Lewis & Son, Toronto.

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Chicago Pneumatic Tool Co., Chicago.

Gears, Reducing.
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Cincinnati Milling Mach. Co., Cincinnati.
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Canadian Rand Drill Co, Montreal.
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Hammers, Steam.
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Canadian Rand Drill Co., Montreal o.
Chicago Pneumatic Tool Co., Chicag

Hose, Air.
Chicago Pneumatic Tool Co. Chicago.

Hose, Couplings.
Chicago Pneumatio Tool Co., Chicago.

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Penberthy Injector Co., Windsor Ont.
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Pratt & Whitney Co., Hartford, Conn

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Machinery Exchange, Montreal.
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Niles-Bement-Pond Co., New York.
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Williams & Wilson, Montreal.

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Cincinnati Milliog MachineCo., Cincinnati
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Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

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Niles-Bement-Pond Co., New York.

Milling Tools.
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Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.

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Allis-Chalmers-Bullock, Moutreal.
Canadian Rand Drill Co., Montreal.
Chicago Pnematic Tool Co., Chicago.
Jenckes Machine Co., Sherbrooke, Que.

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Wells Pattern and Model Works, Toronto

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Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The United Electric Co., Toronto.

Motors, Air.
Chicago Pneumatic Tool Co., Chicago.

Nippers, Stay Bolt.
Chicago Pneumatic Tool Co., Chicago.

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John Bertram & Sons Co., Dundas, Ont.
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Niles-Bement-Pond Co., New York.
Oster Mfg. Co., Cleveland, O.

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American Tool Works. Cincinnati.
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Cincinnati Planer Co., Cincinnati.
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Niles-Bement-Pond Co., New York.
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Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

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John Bertram & Sons Co., Dundas, Ont.

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Saws, Hack.
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Williams & Wilson, Montreal.
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Screw Machines, Automatic.
Pratt & Whitney Co., Hartford, Conn.

Screw Machines, Hand.
Potter & Johnston Mach. Co., Pawtucket, R.I.
Pratt & Whitney &o., Hartford, Conn.

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Oster Mfg. Co., Cincinnati, O.

Shapers.
American Tool Works Co., Ciocinnati.
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Cincinnati Shaper Co., Cincinnati.
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H W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

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Shears, Power.
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Niles-Bement-Pond Co., New York.

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Chicago Pneumatic Tool Co., Chicago.

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John Bertram & Sons Co., Dundas, Ont
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H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Special Machines and Tools.
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Special Manufacturing.
The Globe Machine and Stamping Co. Cleveland, Ohio.

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The Canadian Fairbanks Co., Montreal

Spike Machines.
National Machinery Co., Tiffin, O.
The Smart-Turner Mach. Co., Hamilton.

Steam Separators.
Sheldon & Sheldon, Galt, Ont.
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Stampings, Sheet Metal.
Globe Machine and Stamping Co., Cleveland, Ohio.

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Wm. Abbott, Montreal.
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Chicago P eumatic Tool Co, Chicago.

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A. B. Jardine & Co., Hespeler, Ont.

Switch Boards.
Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co. of Toronto.
The United Electric Co., Toronto.
Volta Electrical Repair Works, Toronto.

Taps and Dies.
Wm. Abbott, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Mechanics' Supply Co., Quebec.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rice Lewis & Son, Toronto.
L.S. Starrett Co., Athol, Mass.

Tapping Machines and Attachments.
American Tool Works Co., Cincinnati.
Bickford Drill & Tool Co., Cincinnati.
Mechanics' Supply Co., Quebec.
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H. W. Petrie, Toronto.
Pratt & Whitney, Cincinnati, O.
L. S. Starrett Co., Athol, Mass.
Williams & Wilson, Montreal.

Time-Recording Clocks.
Canadian Time Recording Co., Toronto

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Williams & Wilson, Montral.

Transmission Machinery.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Transmission Supplies.
The Goldie & McCulloch Co., Galt.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.

Tube Expanders (Rollers).
Chicago Pneumatic Tool Co., Chicago.

Turret Machines.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Upsetting and Bending Machinery.
National Machinery Co., Tiffin, O.

ALPHABETICAL INDEX.

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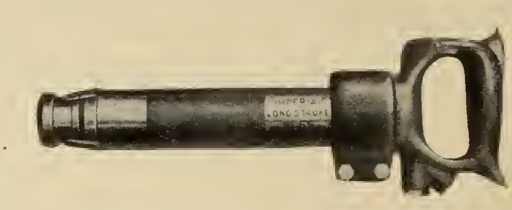

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Let us send you a tool on trial, test it under your own conditions, and if not satisfactory return it to us, ***at our expense.***

Can we do more to show our confidence in these "Made in Canada" tools ?

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10″ x 4′ Sebastian Foot Power and c s.
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14″ x 6′ Flather, R. & F. rest.
14″ x 6′ Reed, R. & F. rest.
17″ x 6′ Gray, Plain rest.
18″ x 6′ Jones & Lamson, R. & F. rest.
18″ x 6′ Perkins, R. & F. rest.
20″ x 10′ Bement Compound rest.
24″ x 12′ LeBlond Compound rest with chuck.
24″ x 14′ Lodge & Shipley Compound rest and taper.
24″ x 16′ Fifield Compound rest.
26″ x 22′ Pond Compound rest.
38″ x 16′ Fifield Compound rest with R. B. to swing 50″.
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20″ x 12′ Schumacker & B. Screw Cutting, compound rest, with turret on shears having power feed.
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42″ x 36″ x 11′ Wm. Sellers & Co.
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No. 1 Cady Solid Back.
No. 2 Toledo Inclinable Open Back.
No. 3 Stiles Plain Solid Back.

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24″ Gould & E. Double Triple Quick with E. Base.

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No. 3 Garvin overhanging arm, vise and vertical fixture.
No. 14 Kempsmith Plain with back gear and power vertical feed.
No. 2 Lodge & Davis Plain with back gear and 12″ Index Centers.

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36″ Snyder S. H. B. G. Q. & P. H.
5′ Arm Niles Semi Universal Radial (Niles.)

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No. 1 10″ Giant, capacity up to 1$\frac{1}{2}$″.
No. 2 13″ Giant, capacity up to 1$\frac{1}{2}$″.
No. 1 Davis, capacity up to 1″.

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No. 1 Apex, capacity $\frac{1}{2}$″ to 2″. R. & L., dies and nipple attach.
No. 1 Apex, capacity $\frac{1}{2}$″ to 2″, R. H. dies.
No. 30 Curtis, $\frac{1}{4}$″ to 2″, R. L., Dies for hand power, side attach mounted on stand.
No. 6$\frac{1}{2}$ Merrell, capacity 1″ to 6″, hand and power.

Screw Machines

$\frac{3}{8}$″ Cleveland Automatic.
$\frac{5}{8}$″ Cleveland Automatic.
No. 3 Warner & Swasey, Plain Head, wire feed.
14″ Garvin Friction Geared Head, auto. chuck.

Brass Workers' Machinery

No. 1 American Tool & Machine Co., Fox Turret.
No. 2 American Tool & Machine Co., Cabinet Turret Lathe.
No. 1 American Tool & Machine Co., Square Arbor Fox Lathe with Chasing Bar.
2-Spindle Bardons & Oliver Valve Milling Machine.
Cock Grinder, Warner & Swasey, on column.
Cock Grinder, Warner & Swasey, on legs.
9″ Windsor Plain Head Turret Lathe.
16″ x 3″ W. & S. Plain Head Turret Lathe.

Speed Lathes

12″ Warner & Swasey, with slide rest.
15″ With set-over tail stock and two motions to spindle.
15″ Pryibil with slide rest.
11″ x 5′ with pan, set-over tail stock, double cut-off, turret tool fitted to tail stock.
9$\frac{1}{2}$″ Brown & Sharpe Polishing and Finishing Lathe.

Cutting-off Machines

2″ Pratt & Whitney Single Tool.
4″ Hurlburt & Rogers, accelerated speed with two tools.

Punches and Shears

No. 6 Long & Allstatter Single End, 4″ throat, cap. $\frac{1}{2}$″ in $\frac{1}{2}$″ with Shear blades.
No. 1 Bremer Single End, 5″ throat, cap. $\frac{3}{8}$″ in $\frac{3}{8}$″.
No. 2 Bremer Single End, 6″ throat, cap. $\frac{1}{2}$″ in $\frac{1}{2}$″, extra blades for angle iron and four punches.
No. 2 Bremer Blacksmith 7″ throat, cap. punching $\frac{1}{2}$″ in $\frac{1}{2}$″; shearing flat $\frac{1}{2}$″ x 4″; round 1$\frac{1}{8}$″.
No. 3 Bremer Single End, 7″ throat, cap. $\frac{5}{8}$″ in $\frac{5}{8}$″, with shear blades.
No. 3 Bremer Ditto, with 24″ throat.
No. 1. Bremer Single Edd, 10″ throat, cap $\frac{3}{8}$″ in $\frac{3}{8}$″, with shear blades
No. 5 Bremer Double End, cap. 1″ in 1″, with shear blades, 12″ throat.
No. 3 Bremer Blacksmith, cap. punching $\frac{3}{4}$″ in $\frac{3}{4}$″, shear, flat $\frac{3}{4}$″ x 4″; round 1$\frac{1}{2}$″: 7$\frac{1}{2}$″ throat.
Heavy Alligator Shear, 12″ blades.
No. 2 Buffalo Hand Power, cap. $\frac{1}{4}$″ in $\frac{1}{4}$″, $\frac{3}{4}$″ round, 7 16″ x 2″ flat.

Wet Tool Grinders

No. 1 Diamond Bench.
Double End, Leland & Faulconer, wheels 24 x 1$\frac{1}{2}$.
Forming Tool Grinder, cup wheel 10 x 1$\frac{1}{4}$, Foote, Burt & Co.
12 x 1$\frac{1}{4}$, wheel on column with pump, Springfield Glue & Emery Wheel Co.
20″ x 3″, wheel on stand, Standard Machine Co Holyoke.
No. 2 Diamond on column, wheel 12 x 1$\frac{1}{2}$.
24 x 2″ wheel, W. F & John Barnes.

Miscellaneous

36″ Swing Lathe for facing columns, with parallel 6″ higher, with flange and test hole drills.
44″ Dorner & Dutton Car Wheel Borer, with 36″ chuck.
200 Ton Horizontal Hydraulic Press, capacity 72″ x 12′ centres
9′ Wm. Sellors & Co., Boring and Turning Mill.
14″ Industrial Works Single Head Axle Lathe 8′ 4″ centres.
9″ Bement Slotter.
14′ 6″ Wm. Sellers & Co.. Plate Planer.
3″ Woodward & Rogers Centering Machine
No. 3$\frac{1}{2}$ Dayton Swaging Machine, $\frac{3}{4}$″ capacity for tubing.
No. 4 Adams Double Head Bolt Cutter with dies $\frac{3}{8}$″ to 1,″. self-opening heads.
$\frac{1}{8}$″ Adt. Automatic Straightening and Cutting-Off Machine, 16″ and shorter with countershaft.
Rotary Slotting Machine up to $\frac{1}{4}$″, series H-Garvin.
No. 1 Horizontal Tapping Machine up to 3 16, Garvin.
5 Ton Crane 14′ Mast.
8 Ton Chain Hoist.
Pulley, Drilling and Tapping Machine.
No. 4 Flexible Shaft with stop clutch and clamp die.
No 1 Root Horizontal Rotary Blower.
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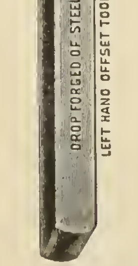

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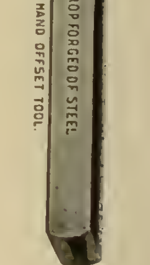

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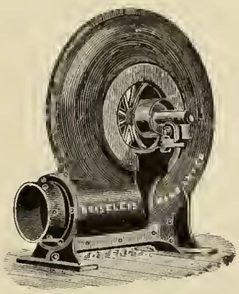

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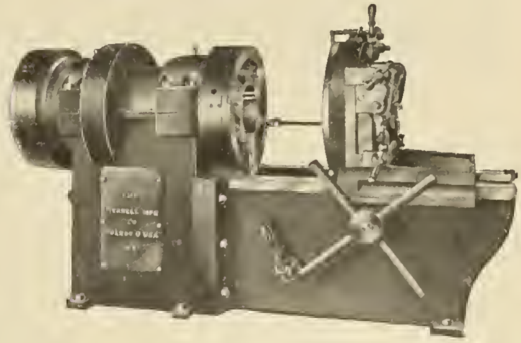

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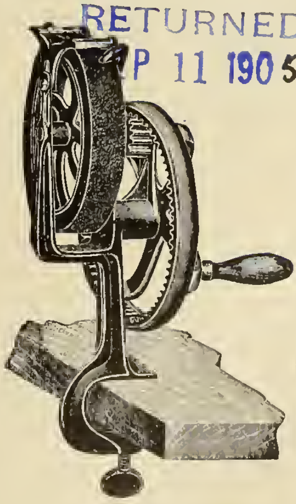

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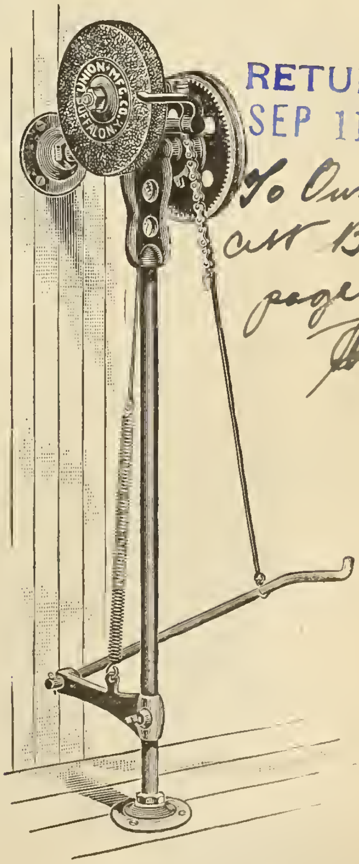

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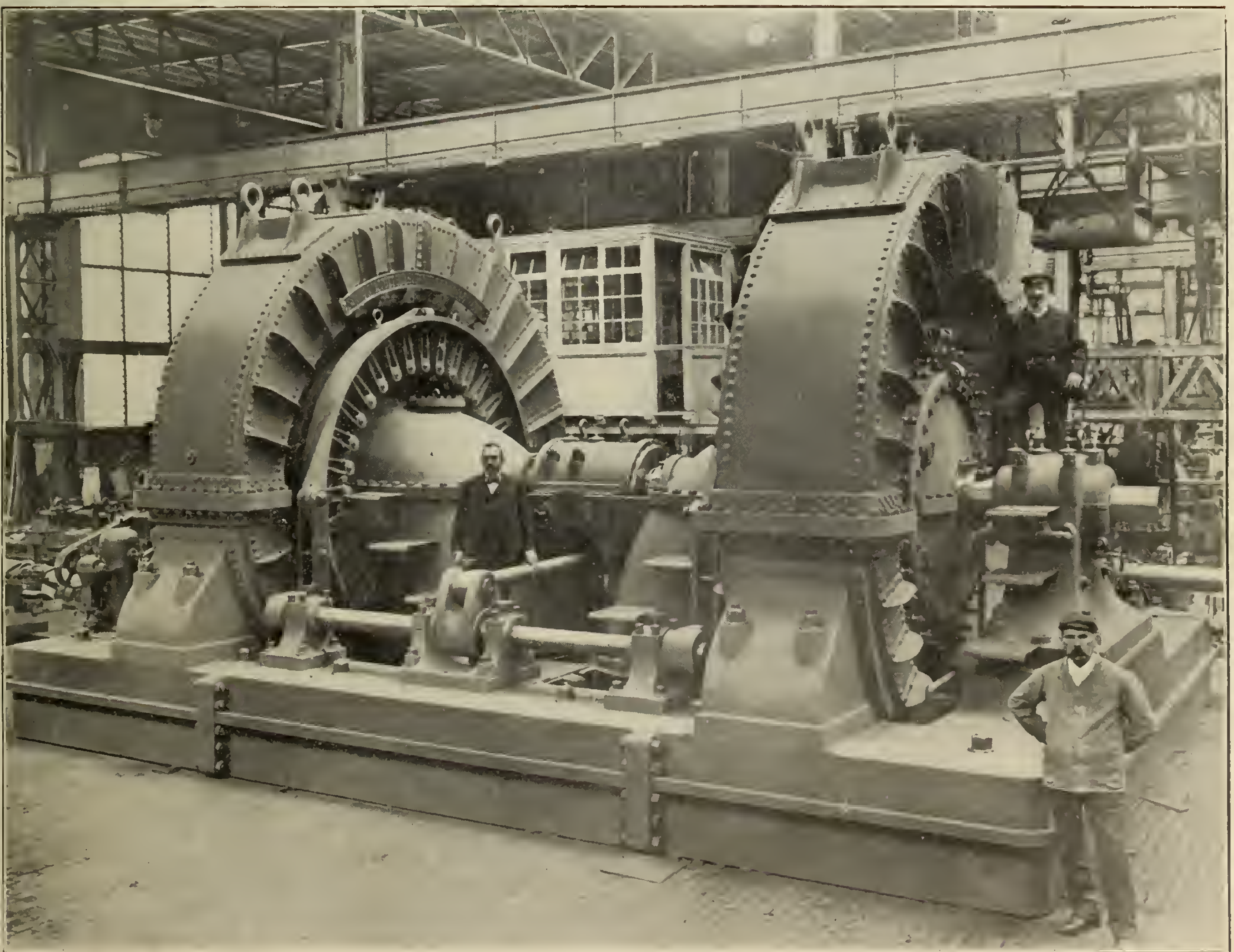

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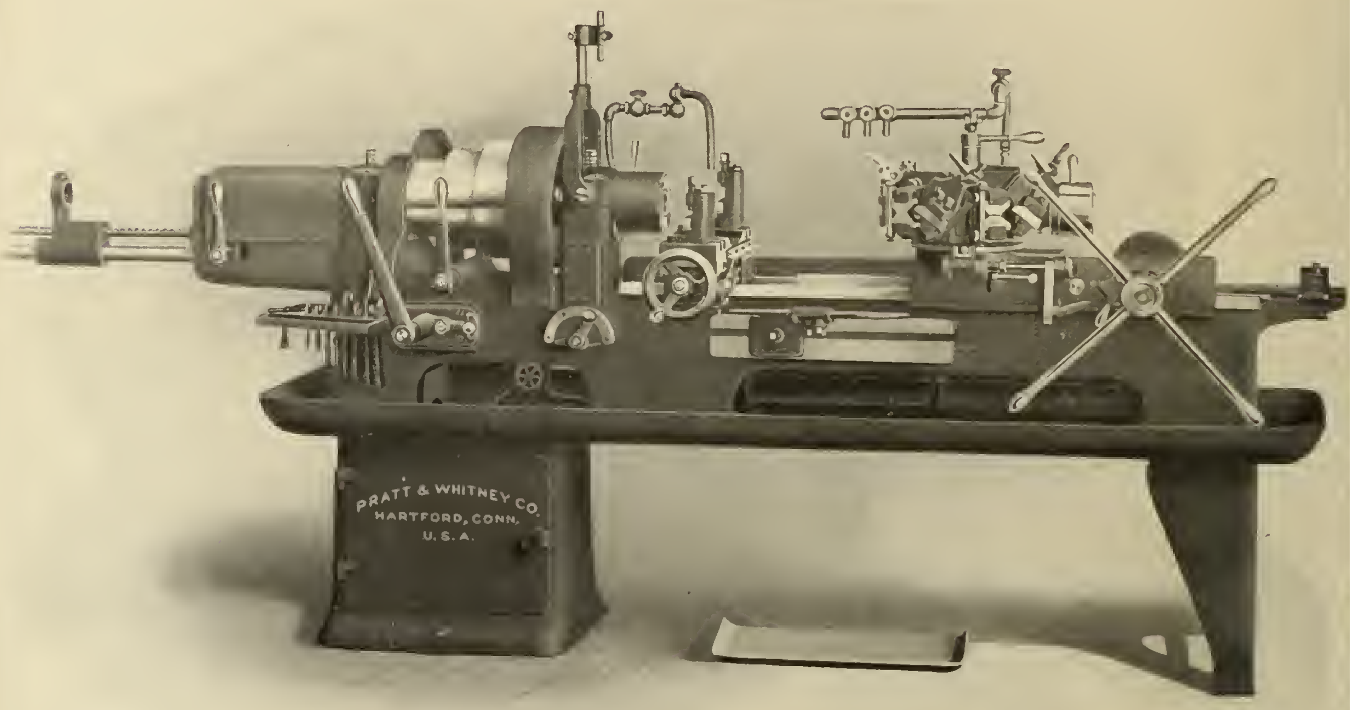

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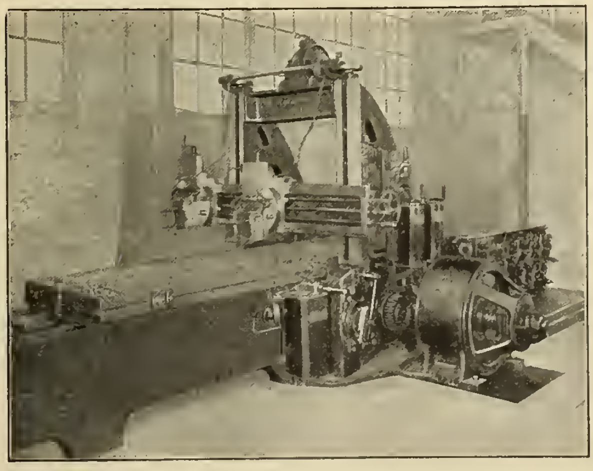

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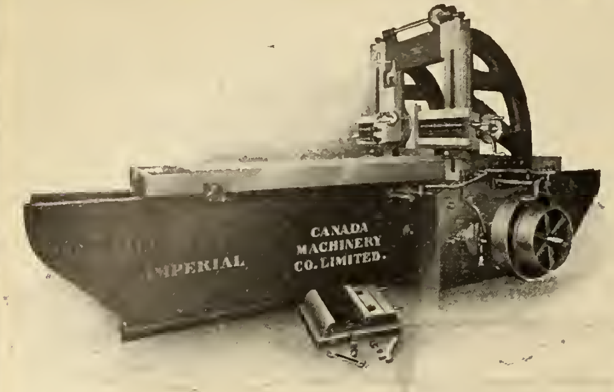

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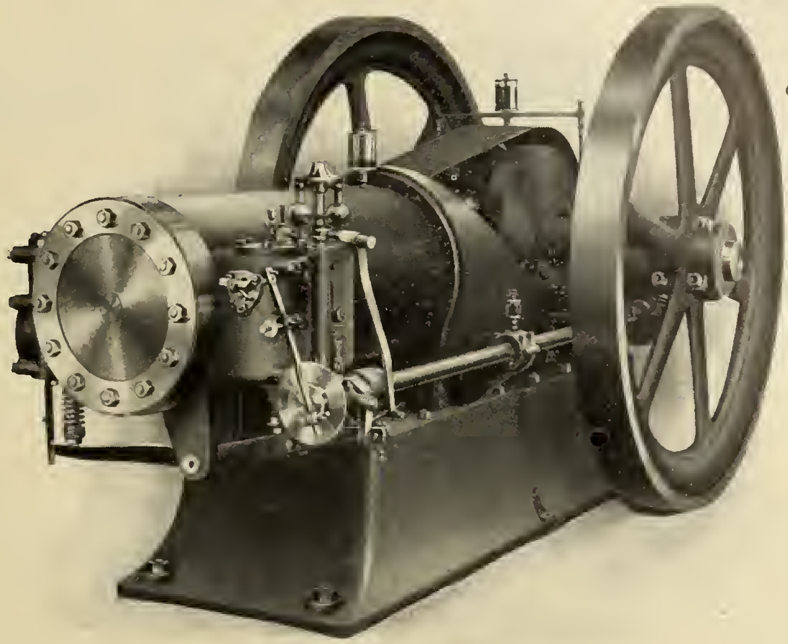

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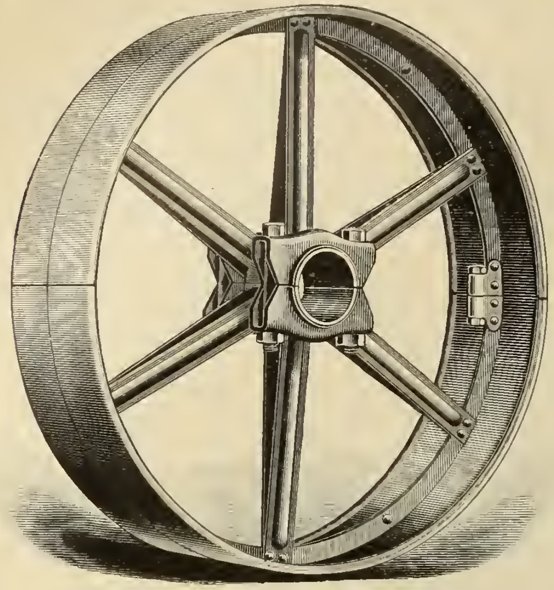

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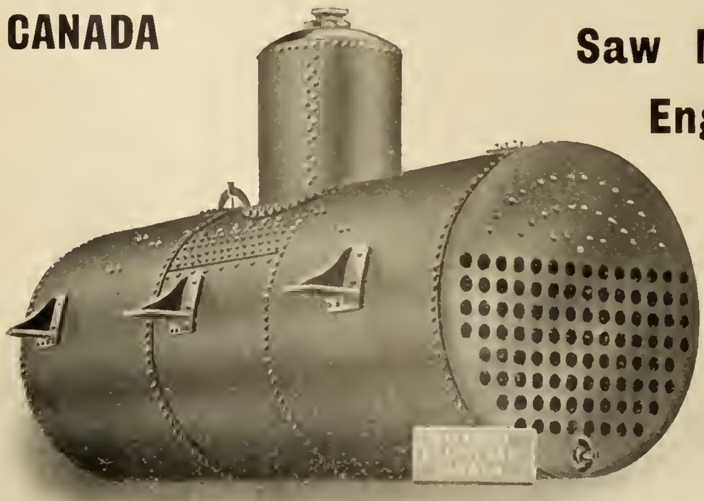

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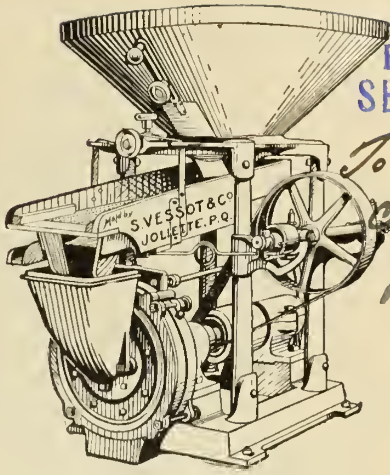

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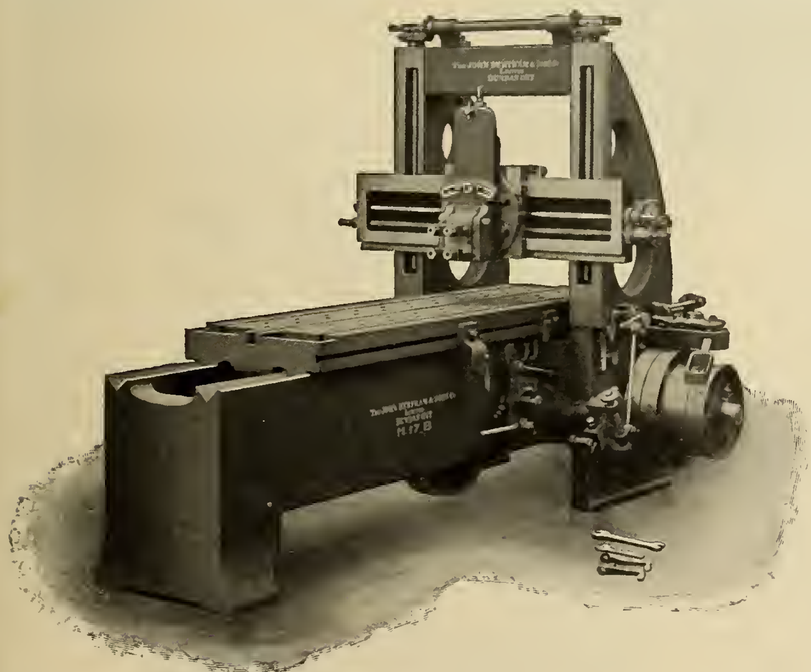

Of Bertram Planers is based on merit, which even competitors acknowledge. Why? Because they will do more work in less time than any "High Speed Return" Planers of their size on the market. This claim is made advisedly. We have got the proof and it will make interesting reading to those interested in planer progress. Write for it.

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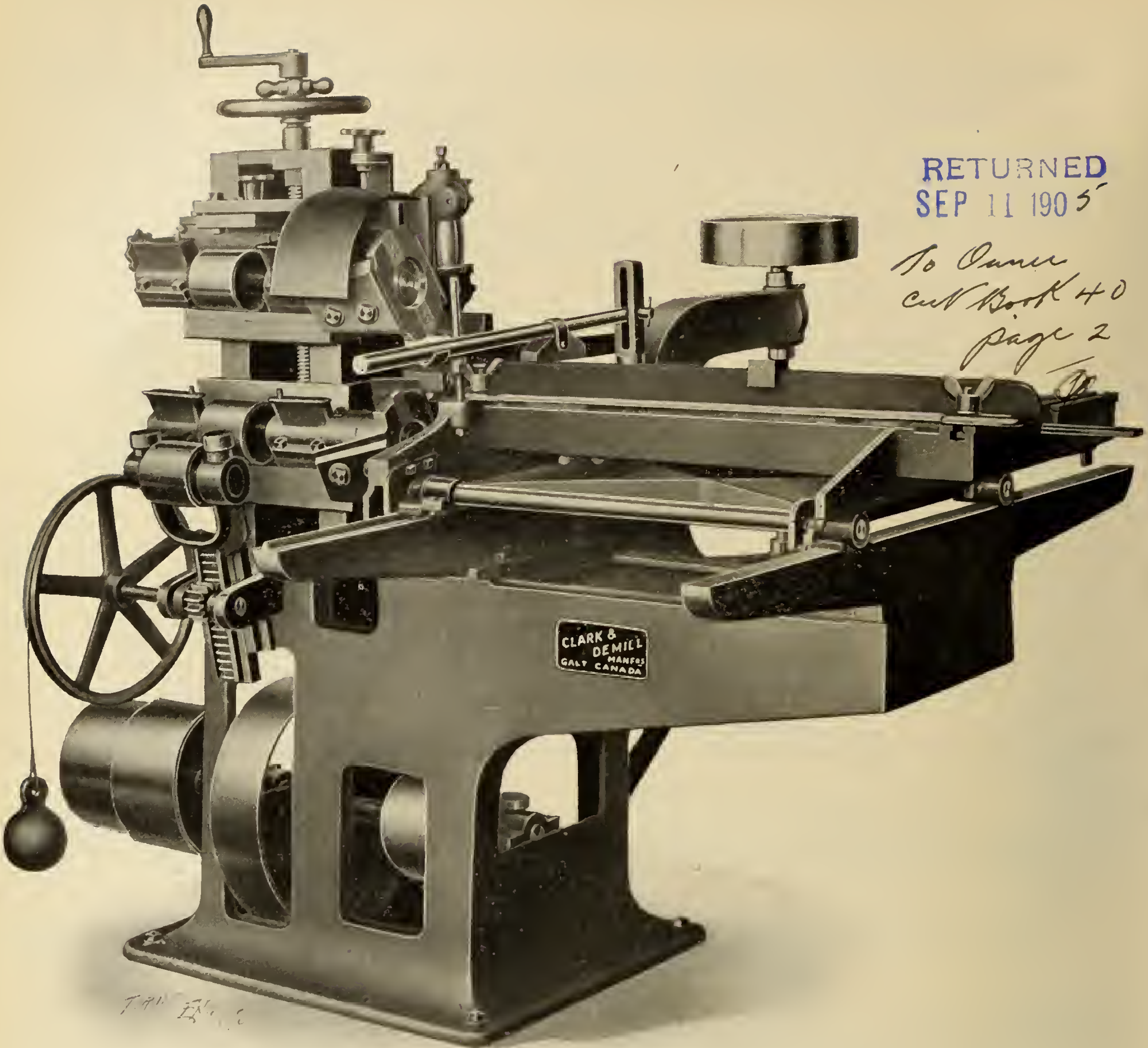
THE JOHN BERTRAM & SONS CO., LIMITED

DUNDAS, ONTARIO, CANADA

To Owner
cut Book 40
page 2



Here we illustrate our No. 75 Tenoning Machine, with double copes for tenoning doors, sash, and furniture work, etc.

The Frame is cast in one piece, extra heavy, and constructed to stand the most severe strain. The Table is of improved roller design.

This machine is also made with double copes and cut-off saw; with single copes; with cut off saw, no copes; without copes or saw.

If you want anything in the way of Planer and Matchers, Surface Planers, Jointers, Moulders, Shapers, Hand and Power Feed Rip Saws, Swing Cut-off Saws, Boring Machines, Mortisers, Band Saws, and Band Re-saws—in fact, anything in the line of wood-working machinery and supplies—write us for prices and secure the best for least money.

GIVE US A TRIAL. Now that we are located in our new shops in Hespeler, we can supply your needs in a very reasonable time.

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Successors to CLARK & DEMILL, Galt, Ontario, Canada.

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to ....
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Page No. 21

No. 3 Gear Feed Universal Milling Machine

Becker Brainard

GEAR FEED UNIVERSAL

Milling Machines

are carefully designed and proportioned to withstand the strain of high speeds and heavy cuts necessary to rapid production.

Also have every convenience of adjustment to assist operator in rapid handling of work.

Ask for catalogue or let us furnish time estimates on your milling work.

Becker-Brainard Milling Machine Co.

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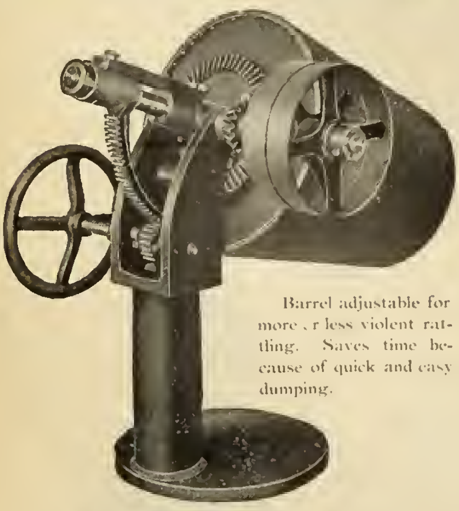
TUMBLING BARREL



Barrel adjustable for more or less violent rattling. Saves time because of quick and easy dumping.

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Insist on getting the one that

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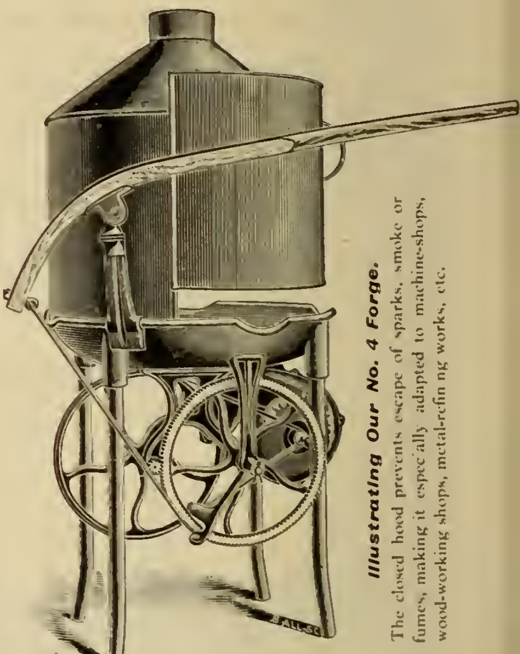

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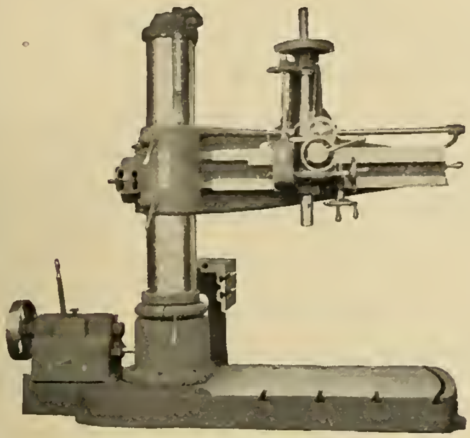

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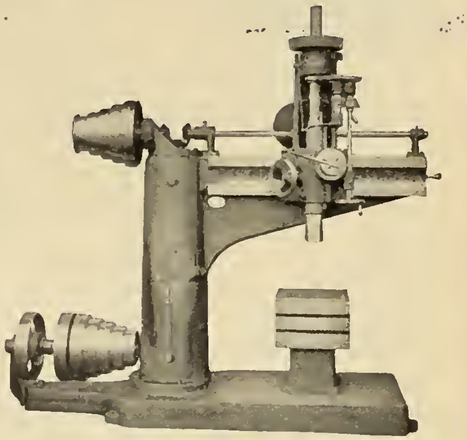

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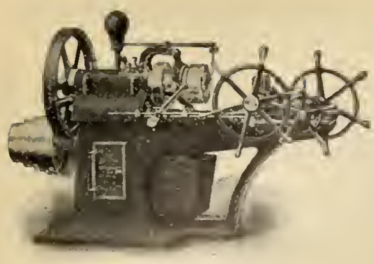

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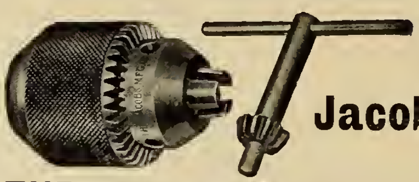

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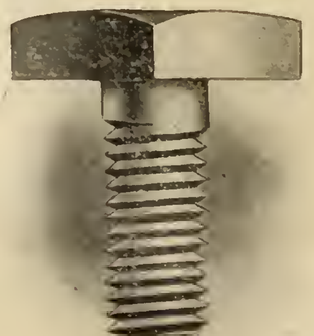

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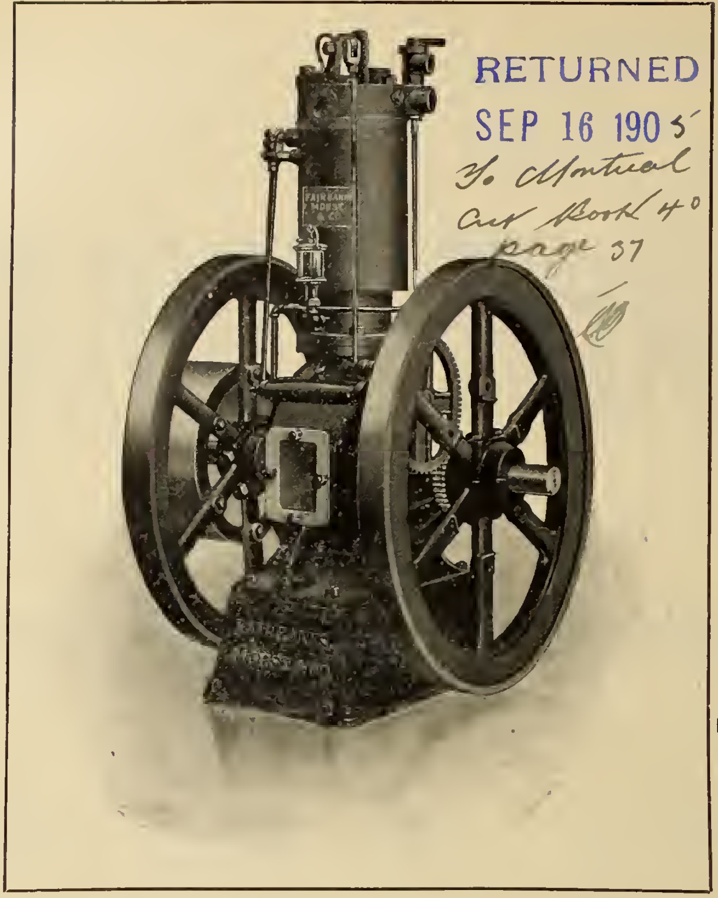

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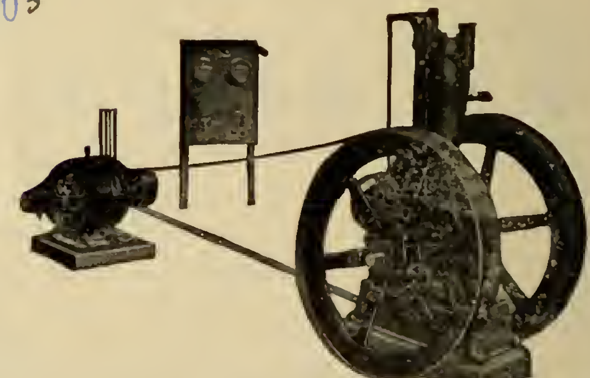

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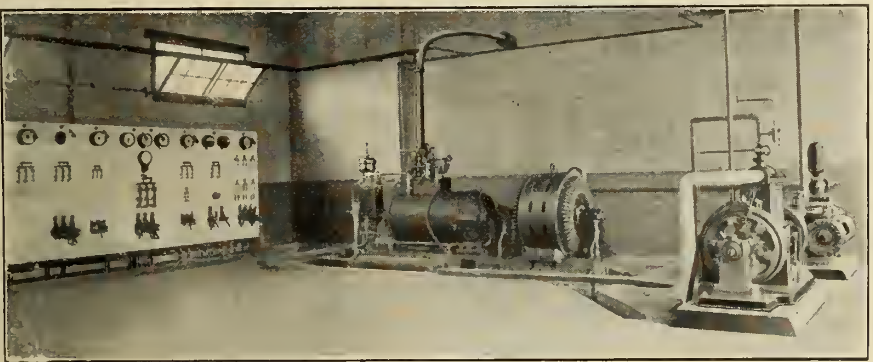
Modern Canadian Manufacturing Plants

ARTICLE VII.—New Works of The Northern Electric Co., Limited, Montreal.

CANADA'S growing time is well exemplified in the plant of the Northern Electric Co., Limited, at Montreal. For many years this firm has been manufacturing telephones, switchboards and electrical apparatus. Their increased business found the works on Aqueduct street, where they employ



Power Plant—Northern Electrtc Co.

over 600 men, too small to cope with the volume of trade, thus necessitating the planning of a new plant, of which the power and boiler houses, drying kilns and wood-working building are constructed and in full operation. Ground has been broken for the other buildings upon the completion of which the entire manufacturing will be done at the new premises. The company's new property is situated in one of the manufacturing districts of Montreal, and includes an entire block, bounded by Notre Dame, Guy, William and Richmond streets, near the Lachine Canal, from which the water supply for all purposes is obtained.

Special Features.

Among the special features adopted in this plant that tend towards economy and mark it as one of special interest, are a complete system for sawdust and shaving carrying and collecting, an industrial railway for conveying the lumber from the kilns to the wood-working machinery, double ball bearings on all the shafting, electric drive throughout, electric elevator in self-contained shaft adjoining the wood-working building, a complete Webster system of heating, a separate building for the storage of oils, varnishes and other inflammable material, and what is further a noticeable feature, is the installation in the power house of the second Westinghouse-Parsons steam turbine unit in operation in Canada.

General Scheme.

When the entire plant is erected the scheme shown in the illustration will be followed out. It will embrace the works now on Aqueduct street consisting of general electrical manufacturing plant for all classes of electrical work and light machinery, including machine shop, foundry, blacksmiths' shop, nickel-plating department, automatic screw machine department, milling machine department, power press department, wood-working department, drying kilns and power plant.

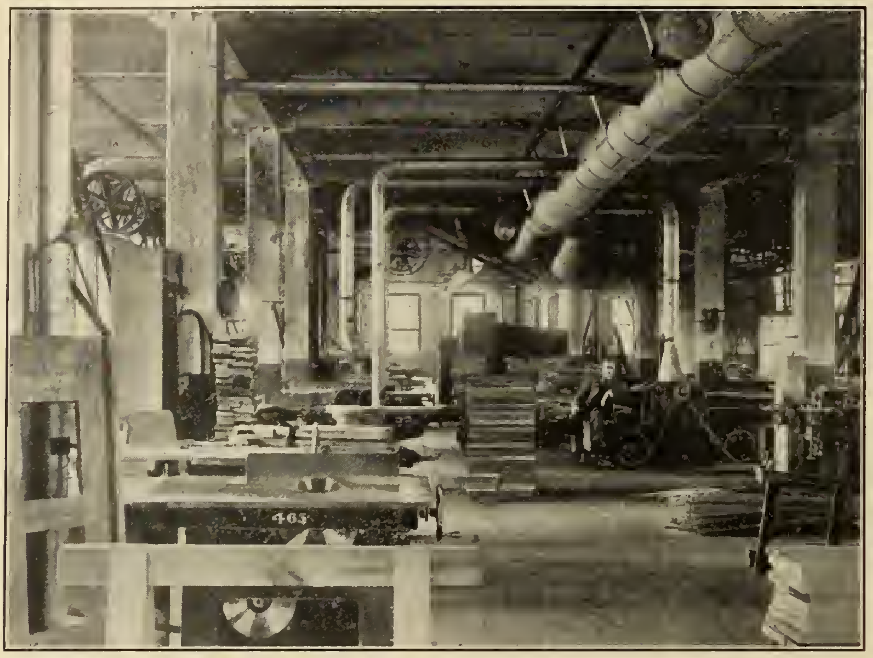
Wood-Working Buildings.

This building, in which are employed at the present time over 100 men, is of slow-burning fire construction, brick on stone foundations, as will be the case of all buildings when completed. It is three storeys, being 200 ft. by 60 ft. On the ground floor are installed the heavier wood-working machines, and on the second floor the finer machine work is done, while the top flat is devoted to polishing and finishing the wood work. In this building is finished all the wood used in connection with the central station switchboard, cabinet switchboard, telephones, etc. As the company supply all the telephones and switchboards for the Bell Telephone Co., the amount of wood used is very extensive. The power for running the machines is supplied by two motors, a 75 h.p. Westinghouse induction motor, suspended from the ceiling for the lower flat, and a 30 h.p. motor on the first floor, placed in the same manner, economising space and making a neat insulation. Each motor is provided with two double crown pulleys, thus running four lengths of shafting, fitted with friction clutch pulleys, enabling any one shaft to be run in-

View in Wood Working Department.

dependently of the others. Besides supplying the power for the machines, one of these motors in turn operates a double exhaust Sturtevant fan used in

conjunction with the extensive dust collecting system that has been installed. Machinery installed consists of several types of saws, planers, morticing machines, doweling and finishing machines, besides special apparatus for sharpening the saws and grinding the knives of the machines. In all, there are 60 machines,



Another Floor in the Wood Working Department.

embracing the best and most up-to-date available for wood-working.

Drying and Handling Lumber.

For this purpose two large drying kilns have been built between the wood-working building and the power house, connected with which is a complete industrial railway. The kilns are divided into three compartments, each compartment being large enough to contain four cars. The lumber is piled on the cars and run in and out as desired, a turntable being connected with the track. Each kiln contains two lines of track connected with another running into the wood-working department, and when the lumber is dried sufficiently the cars are run from there into the wood-working building to a point where it necessitates but one handling to place them in the machines, either for sawing or dressing. As the handling of lumber in an establishment of this kind is always one of the heavy items of expense, the value of such a system is at once recognized.

Dust Collecting System.

Owing to the dust that usually prevails where saws, wood planers and other wood-working machines are in operation, such a place has been considered undesirable for workmen. With up-to-date methods, however, any unhealthy element that has heretofore prevailed has been eliminated and the dust-collecting system that is now being installed enables the atmosphere to be kept as clear, and the floor as free from shavings and dust as in any industrial establishment. The system installed in this instance has been placed by the Sterling Power & Blower Mfg. Co., of Hartford, Conn. It consists of two Sturtevent fans, and large sheet iron pipes leading from each floor and passing over the roof to a large receptacle immediately over the power house and thence is directly connected to the boiler furnaces. Not only sawdust and shavings, but small pieces of wood are carried with facility through the pipe. This not only obviates the necessity of handling the refuse from the wood-working machines, but enables the place to be kept as clean as could be desired.

The heat supplied to the wood-working building, and which will later be conveyed to the entire establishment, is to be had from the exhaust steam of the turbine in the power house. The system adopted is known as the Webster system, installed by Darling Bros., of Montreal. It has been found satisfactory in maintaining an even temperature in industrial concerns, with a central station plant, and the cost of heating is reduced to a minimum.

Boiler House and Stack.

The steam for the supply of power and heating is generated by two 250-h.p. Babcock & Wilcox water tube boilers, operated at 200 lb. per square inch pressure. These have been installed, leaving room in the boiler house for further additions if necessary. The latter is of brick and concrete on stone foundations, as is the case with the power house and drying kilns. Mechanical stoking has been adopted. The boilers are equipped with four Jones underfeed stokers, with the operation of which considerable economy is claimed. The stack in connection with the power house was built by the Alphonse Custodis Chimney Construction Co., of New York, who make a specialty of chimney building and have built such in all parts of the country. It is of brick on concrete foundation, being 100 feet 10 inches high, and 7 ft. 6 inches in diameter at the top of the flue. The foundations are 14 ft. square.

Engine Room.

The engine room of this plant is of peculiar interest, inasmuch as in it is at present running the second Westinghouse-Parsons steam turbine unit to be installed in Canada. It is of 400 h.p. capacity, direct connected to a 300 kilowatt Westinghouse alternator, three-phase, sixty-cycle, 220-volt. A short description of the turbine will be of interest. The rotating element is built up of cast steel drums carrying rows of blades or vanes, these being mounted on a steel shaft. These drums are arranged in three steps of increasing diameters, but the selection of three diameters is

Part of New Plant—Northern Electric Co., Montreal.

merely for mechanical convenience. Provision for the proper expansion of the steam might be made whether there be one or several diameters. If, however, a speed and diameter of rotor be selected that would permit of a convenient size of blades at the outlet, those at the inlet would become inconveniently small, and vice versa. By varying the drum diameters at several convenient points, the proper velocity relations between steam and vane may be preserved, and at the same time the number of different sizes of blades may be reduced to a minimum.

Opposed to the three sets of blades the spindle also carries three rotating balance pistons, each of such diameter as to exactly balance, by means of the passages, the axial thrust of the steam against its corresponding drum of blades. These balance pistons revolve within the cylinder with a close fit but are not in mechanical contact. The adjacent surfaces are provided with frictionless packing rings which offer so devious a path for the steam as to make leakage past them inappreciable. The shaft also carries a small thrust, or, more properly, adjustment bearing, whose sole function is to maintain the normal mechanical clearances between the rotating and stationary blades. These clearances may be conveniently large without lowering the efficiency. In actual practice they are never less than one-eighth inch, and in large blades are as much as one inch.

The alternator will supply electric power to drive induction motors in all the different buildings where machines are to be run. The exciting current for the generator is supplied by a 10 k.w. 110-volt D. C. Westinghouse generator, direct connected to a Westinghouse junior high-speed engine of 17 h.p. The switchboard is the product of the Northern Electric Co., and contains seven panels of Italian marble. The main panel is equipped with three ammeters, a recording watt meter, a main switch of 400 amperes and I-T-E- circuit breakers. Each one of the motor panels contains a watt meter, a main switch and circuit breaker, all instruments being those of the Westinghouse type. The wires for connecting the switchboard with the several buildings are run through a tunnel at the back of the engine room, and kiln, and open up on the ground floor of the wood-working department. In this tunnel are also carried water and steam pipes, the latter being covered with magnesia sectional covering. All the wiring in buildings is enclosed in iron conduits.

The sprinkling apparatus to be installed will be the latest and in full accordance with underwriters' regulations.

When completed this plant will be a noteworthy one in many respects, being designed with a view to economy of operation and being installed with the latest and most improved machinery and equipment available.

Modern Milling Practice

By John Edgar—(Continued from July)

Effect of Dull Cutters.

Dull cutters are the cause of a good many failures in milling practice. Cutters must be kept sharp because (1) they require more power when dull, consequently the machine cannot work at its highest efficiency; (2) they strain both the machine and cutter arbor, causing the latter to spring, allowing the cutters to leave the work when any hard spots are encountered, and to run out of true; (3) the surface left by a dull cutter is anything but satisfactory, it being impossible to obtain a true surface under such conditions. Therefore we cannot pay too much attention to this, and to do our utmost to keep the cutters in good condition.

Another serious effect dull cutters have is that of heating, causing the work to buckle and producing the proverbial hollow surface. This heating is the one difficulty over which one may stumble and fall over. It requires but little care to entirely obviate this trouble since it is on long work that its effect is most apparent, and we must so adjust the speed and feed so as to reduce it. It is here that the use of high-speed steels are found to be of much limited value, since their object is to increase the speed, consequently the heat. We will find very little advantage in using them on large heavy work, but for small work where the cutter is not long in contact the benefit derived from their use is incalculable.

Precaution Essential.

One of the greatest annoyances we run up against in milling practice is to have the cutters run out of true so badly that the greatest part of the work falls on one or two teeth only, leaving the surface milled full of ripples. An arbor does exceedingly good work in many cases, considering the amount of abuse that is heaped upon it. I have seen the most possible care taken in making the arbor; valuable time spent in making sure that it run absolutely true, only to be thrown down with such force as to bend it and spoil all the good that was done on it. You have no doubt noticed the rough use it gets when the operator tightens the nut, sometimes using a heavy hammer with the only possible effect of bending the arbor so as to run out of true. Too much care cannot be practised in handling the arbor even to that of storing it away. The most frequent cause of the untrue running of cutters, even in the best practice, is that of untrue collars. Should the collars be out of true on their faces, the pressure of one against the other, such as is exerted when the nut is brought up tight, cannot help but buckle the arbor. Even the least amount produces this undesirable effect on the true running of the cutter. The remedy for this cause of the trouble is in the use of rocker collars, which are so constructed they they accommodate themselves to the untrue condition of the adjacent collars.

Should the trouble still exist after taking this precaution, we must look elsewhere for our cause. There are several possible ways that this could happen in grinding the cutter. Should the cut be too heavy the emery wheel will take more off one tooth than off another due to variance in hardness. Should the load on one tooth be wider than that of another the same effect is the result. If the operator in going around the cutter should miss one or two teeth, these teeth will evidently be of larger diameter than the others. While these are not all the ways this could happen it may be the means of causing more care being taken in this direction.

A Special Instance.

To show that it is possible to obtain in practice a surface which is practically free from these ripples, I will give the following instance. Platers bars of brass require a finish that must be practically perfect. It was desired to obtain this surface on a milling machine.

It was accomplished on a small, plain machine at a feed of 10 inches a minute, and the surface obtaining was almost devoid of feed marks and was almost as reflective as a mirror. This goes to show that with a little care it is possible to get any grade of finish desired, and that at the expense of an amount of time which will compare favorably with the time taken by any other method.

I am sorry that time and space available for such work does not permit me to be more explicit in some matters touched upon in this article, but hope that I may have the pleasure of treating more fully some of the most interesting features found in milling practice in the near future.

Notes on Machine Design

By W. H. Raeburn

Trend of Development.

HEAVY duty requirements on the part of the modern machine tool make it imperative that the designer who desires to produce a satisfactory machine give good heed to the exact conditions with which he has to deal, with the loads and stresses produced and the stiffness or rigidity of the various parts.

There was a time when machines were not taxed as they are to-day, and builders did not feel called on to examine so critically the proportions of some of the parts, but were satisfied when, by exercising that good judgment which should come from experience and profiting from the lessons taught by failure, they built a machine that stood the test of use. It is not a little surprising to find that principles known many years ago are only now being applied by machine designers. We see the advertisements of the best known machine tool builders, which announce that the speeds and feeds of their machines are arranged in geometrical progression. Until quite recently the proportioning of cone pulley diameters and back gear ratios was done in a sort of haphazard way to suit the fancy of the designer, and writers in the American machine papers have shown up in rather a bad light the drives of lathes built by well known firms. Geometrical progression is nothing new, and one is rather surprised to think that it has been so late in appearing as a point in correct design, for all admit that it is the proper thing in the majority of cases. Of course there are exceptions.

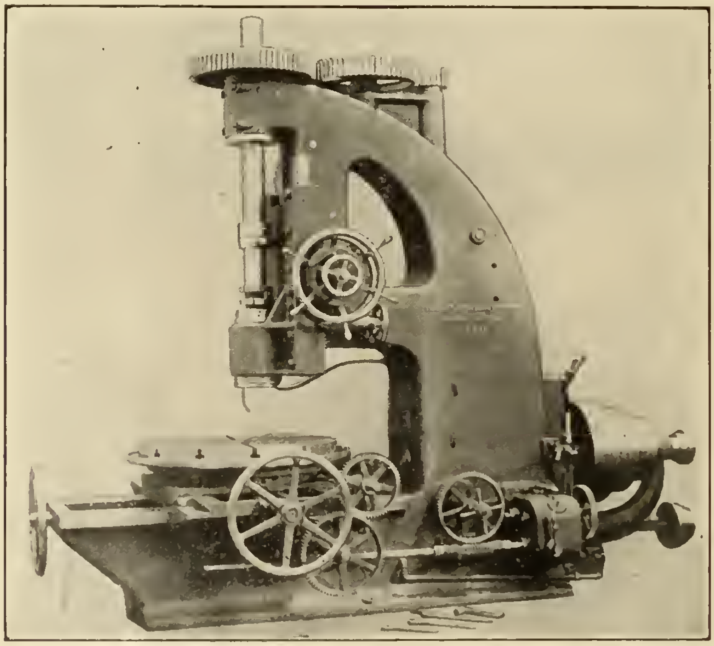


Fig. 1—New Bertram Vertical Milling Machine.

No one can afford to belittle the value of practical experience, although the lessons taught are often quite costly. It would appear sometimes as if many of these expensive lessons were unavoidable, yet not a few of them might be learned in a different way, more satisfactory from a financial standpoint, by an investigation of some of the broad principles underlying the proper design and construction of a machine. Theory and actual practice must go hand in hand, in fact the greater part of theory is obtained by inductive reasoning from observed facts, and the wise designer will seek to know all that others have learned from experience in constructing and operating the particular class of machine he may have in hand.

The fundamental principles of the strength of materials have been ably demonstrated by many writers, yet a large amount of guess work has been done in assuming dimensions for parts of machines that could easily have been properly designed by the aid of comparatively simple formulae, and this decided advantage comes from following the latter course, that one's mind is not so unsettled as when a shrewd, or perhaps a wild guess, has been made. Then from the cost side, we feel sure that there has neither been a wasteful use of material and labor, nor false economy, which would only result in disaster.

Designing a Screw.

One of the primary elements in mechanism is the screw, yet it is but indifferently understood by many. A powerful, although in many cases a wasteful servant, the screw performs work that cannot well be done by any other means. The writer recently designed a machine in which a screw was required to exert a pressure of 350,000 pounds. The mechanical efficiency of the screw adopted was only 38½ per cent., and when calculations were made to show the loss at the thrust bearing when brass collars are used, as is the practice of builders of similar machines, the combined efficiency of screw and thrust bearing fell to 19 per cent., a rather low figure. The substitution of a roller thrust bearing practically eliminates the loss at that point. A few words on the efficiency of screws may not be out of place. The clearest demonstrator of the theory of the friction of screws known to the writer is that given in "Lessons in Applied Mechanics," by Cotterill and Slade. The formula there deduced is given in Kent's pocket book, where reference is made to the proof in the former work, but Kent does not give the formula in its most easily remembered form, which is, efficiency

$$=\frac{\tan. a}{\tan. (a+\beta)}$$

a being the angle of the thread and β the angle of friction, the tangent of which expresses the coefficient of friction. In the case of low thread angles the form

$$E=\frac{\tan. a}{\tan. a+f}$$

where f is the coefficient of friction gives results approximately correct, and is a very simple formula. In the case of the screw mentioned above, the outside diameter is 6⅞" and the pitch 1¼", a thread square, so that the tangent of the angle of thread is

$$\frac{1.25}{6.25\,\pi}=.0636$$

corresponding to 3 deg. 38 min.

The screw being steel and the nut cast iron, a fair coefficient of friction would be .1, which is the tangent of 5 deg. 13 min., solving

$$\frac{\tan. 3°\ 38'}{\tan. 9°\ 21'} \text{ we have } \frac{.0636}{.1646}=.386$$

the efficiency of the screw. It is possible to obtain a lower coefficient of friction than .1 by the use of carefully finished surfaces of screw and nut, and by very good lubrication, but these surfaces might not be quite as smooth as could be desired, and the element of

chance in the lubrication is considerable, so that a coefficient of friction even higher than .1 might be reached. If it were as high as .15 the efficiency of the screw would be .29. It should be stated that the screw in question revolves very slowly, a little over a revolution per minute.

The loss at the thrust bearing is calculated as follows:

$$L = \frac{4\pi}{3} f P \frac{R^3 - r^3}{R^2 - r^2}$$

where L is the loss of work in inch pounds per revolution, f the coefficient of friction, P the pressure on the bearing in pounds. R and r the outer and inner radii of the bearing. Taking f as .08 the loss, calculated from this formula is 1,163,832 inch pounds. The useful work required in one revolution is 350,000×1.25, equal to 137,500 inch pounds, but as the efficiency of the screw is only .386, assuming friction there as .1, there must be delivered to the screw beyond the thrust bearing

$$\frac{437,500}{.386} = 1,133,419$$

inch pounds of work. Add to this the loss at thrust bearing and we have 2,297,251 inch pounds, the actual work imparted in one revolution to produce 437,500 inch pounds effective work. The efficiency of the screw and thrust bearing combined is thus

$$\frac{437,500}{2,297,251} = .19.$$

Should friction exceed the amounts assumed there would, of course, be a corresponding drop in the efficiency.

As has been stated, the ordinary practice is to use brass collars at the thrust bearing and it is only when we make an investigation such as the foregoing that we realize how wasteful of power, and therefore productive of wear, such construction is.

A roller thrust bearing which reduces the loss arising from its resistance to .01 or less having been adopted, matters are wonderfully improved, but there is still the unavoidable loss at the screw. To minimize this, the surfaces in contact must be given a better finish and lubrication be attended to in the best possible way.

To those who have not made a study of the matter this may seem like a condemnation of the use of screws or worms for the purpose of transmitting power, but let such hasten slowly to conclusions and we shall look more deeply into the action of worm gearing. A glance at the formula for the efficiency of the screw shows that it is in direct proportion to the tangent of the angle of thread, so that increasing that angle also increases the efficiency. Another happy circumstance attending the use of the worm at high speeds is that the coefficient of friction between the rubbing surfaces decreases very materially as the speed increases.

Those who desire to study this subject in the light of experiments made by well-known American engineers would do well to read an interesting little book, "Worm and Spiral Gearing," by Halsey. There is even yet some need of missionary work amongst those who thoughtlessly condemn the worm drive. The well known and highly successful worm drive of the Bertram planer has been erroneously pointed to as absorbing a large percentage of the power applied, but neither practical results nor mathematical reasoning justify such a conclusion.

From observation and special tests made by Prof. Thurston and others, it is quite fair to assume that the coefficient of friction between well lubricated surfaces moving at velocities such as are the practice with the Bertram worn, falls to .025 or even lower. Let us select a worm of medium size and study the results obtained. The pitch diameter of the worm is 1.035 ins., and the

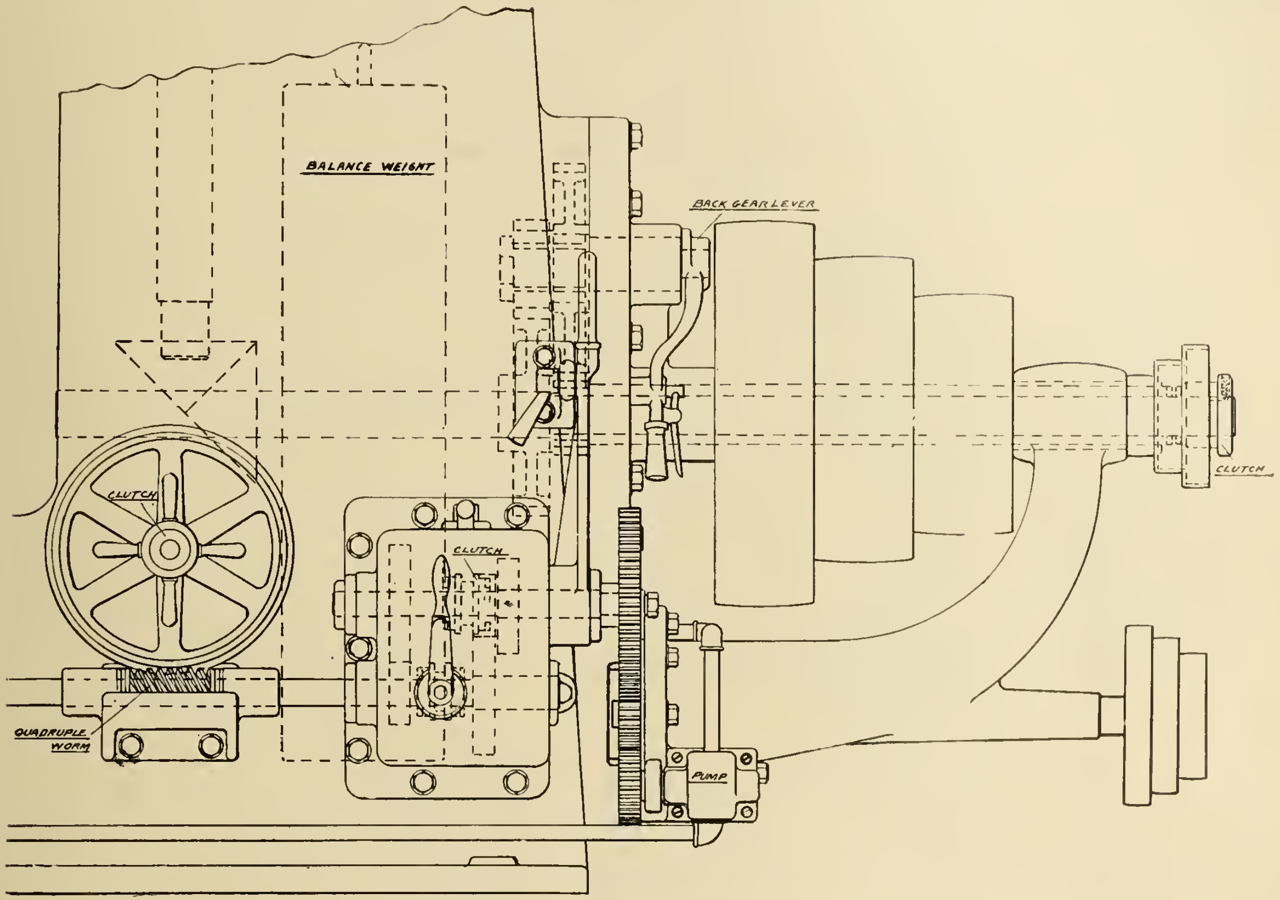


FIG. 2

lead of the thread 5 in., so that the tangent of angle of thread is

$$\frac{5}{4.035\,\pi}=.3944,$$

corresponding to 21 deg. 32 min. Assuming .025 for friction, this is the tangent of 1 deg. 26 min., so that

$$E=\frac{\tan.\ 21^\circ\ 32'}{\tan.\ 22^\circ 58'}=\frac{.3944}{.4238}=.93,$$

a result which is in close accord with the actual performance of the worm and wheel. Thus the combination of high thread angle and high velocity, with its attendant low coefficient of friction, made the Canadian worm a success, while failure was attending the efforts of some of our friends across the line.

Only a few weeks ago a very interest-

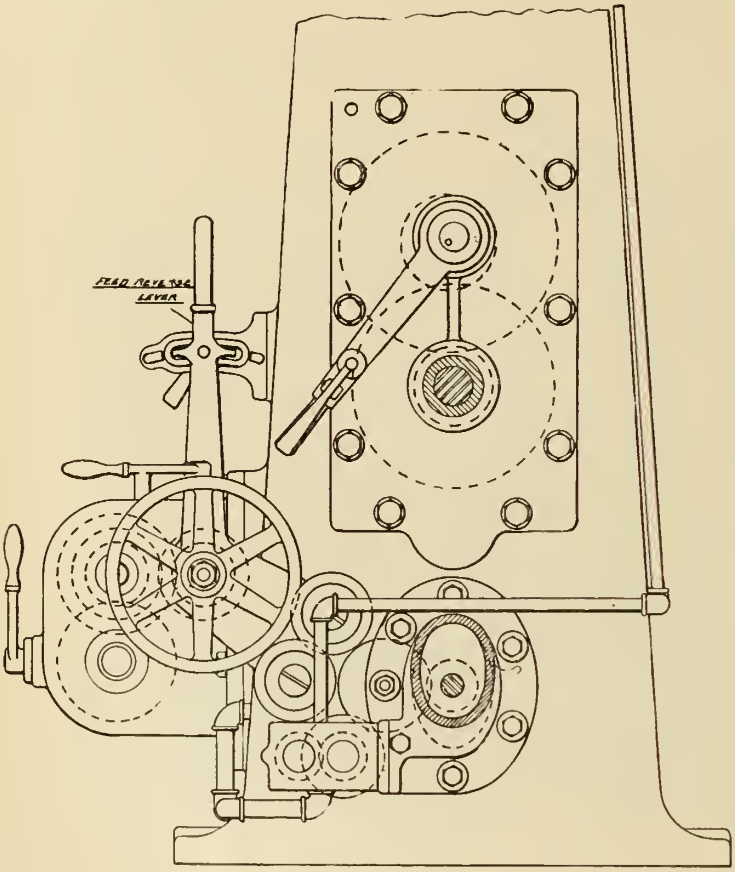


FIG. 3

ing chart came under the writer's notice. It was recently designed and published by a prominent firm of German engineers, whose specialty is gearing of all kinds. This chart gives at one reading the pitch and greatest pitch diameter of a worm necessary to transmit a given horse-power at a given number of revolutions per minute. After converting the metric quantities to our standards a few readings were taken to compare Canadian and German practice, the result being that quite striking similarities were found.

Strength and Stiffness of Shafts.

Another point in machine design that may prove a source of deception to some is the relative stiffness of shafts of different diameters to resist torsion. Strength and stiffness do not mean the some thing. The formula

$$T=.196\ d^3 s$$

gives the twisting moment in inch pounds that a shaft of diameter d will resist when the maximum fibre stress (at the outer layer of fibres) is s. It will be quite evident to all that a 2″ shaft will resist 8 times the twisting moment that a 1″ shaft will, as the cube of 1 is 1, and the cube of 2 is 8, the fibre stress being the same in both cases. The point that is not so well understood, however, is that the 1″ shaft will twist through twice as great an angle as that through which the 2″ shaft twists, the maximum fibre stresses and the lengths being the same. To put it in another way, the twisting moment (with constant fibre stresses) is as the cube of the diameter of the shaft, while the angle through which one end of the shaft twists relative to the other is in inverse ratio to the fourth power of the diameter (the twisting moment being constant.)

This angle is calculated from the formula

$$\theta=\frac{2\ s\ l}{G\ d}$$

θ being the angle in circular measure, l the length of shaft in inches, and G the modulus of transverse elasticity for the material, taken at 11,000,000 lbs. for machinery steel. From this formula it is apparent that the angle of torsion is in direct proportion to the fibre stress and the length of the shaft, and in inverse proportion to the diameter. From

$$T=.196\ d^3 s \quad \text{we have} \quad S=\frac{T}{.296 d^3}$$

and we can modify the formula giving the angle by substituting this value for s, and also by multiplying by 57.296 to convert radians to degrees: we now have

$$\theta^1=\frac{.00005315l\ T.}{d^4}$$

To illustrate the application of these formulae let us take a concrete example: A shaft 2″ diameter is 50 ins. long and power is applied at one end by means of a gear whose diameter is 20 ins., the load on the teeth being 1,000 lbs. At the other end of the shaft is the gear, by means of which the power is taken from the shaft. The twisting moment is here 1,000 × 10, equal to 10,000 inch pounds, and the angle through which the shaft twists in transmitting the load from one end to the other is

$$\frac{.00005315\times 50\times 10{,}000}{16}=1.66\ \text{deg.}$$

This may be allowable or it may not, depending on the circumstances. The maximum fibre stress in this case is

$$\frac{10{,}000}{.196\times 8}=6377\ \text{lbs.}$$

If one were to consult a table of working stresses such as are published in most works on machine design, he might be deceived by accepting a figure like 12,000 lbs. per sq. inch as safe in shear. The shaft we have just considered would not be twisted beyond the elastic limit even with a fibre stress of 12,000 lbs., but we have seen how much the angle of torsion is with a moderate stress such as it is under, and it might be desirable in some cases to go quite low, 4,000 lbs. or even less with the maximum fibre stress. In some classes of work other than shafts a shearing stress of 12,000 lbs. per sq. inch would be all right; there is much to be decided by the judgment of the designer.

Geometrical Progression for Drives.

So much has been written of late on the subject of geometrical progression of speeds that it almost seems superfluous to take up the matter in detail, but it may be that some of the readers of Canadian Machinery have not been made familiar with what geometrical progression really means. The numbers 2, 4, 8, 16 and 32 are in geometrical progression because 4 is twice 2, 8 is twice 4, and so on. If 2 were the slowest and 32 the fastest speed at which it was required to revolve a spindle, and there were to be 5 speeds, then the numbers

given would be correct for those speeds. We are not often favored with such an apparent case as this, however, so we must look for a general formula to cover all cases. In the foregoing, 2 is the ratio of progression. Let us suppose we have a machine the spindle of which is to have 8 speeds, 4 of these being obtained by a direct drive from the cone pulley, the other 4 being through back gears. The slowest speed is 4 and the fastest 108 rev. per min. We wish to obtain the intermediate speeds, the back gear ratio, and, having fixed on the diameter of the largest step of the cone, we desire to know the diameter of the other steps. These symbols will be used in the formulae :

R and r the maximum and minimum speeds respectively of the spindle or shaft. N the number of speeds, P the ratio of progression, D and d the largest and smallest diameters of the cone pulley, and n the number of steps of this pulley.

There is a method of obtaining all the desired speeds, sizes, etc., by means of the slide rule, and it is by far the simplest way as the whole problem can be solved in a few minutes—one minute would suffice for the problem here stated. However, not all are familiar with this most useful instrument, and even many who are may not know the short cuts in the business. We have first of all

$$P=\sqrt[N-1]{\frac{R}{r}};$$

to solve this we must use logarithms either with or without the slide rule as in the case in hand the 7th root has to be extracted.

$$\sqrt{\frac{108}{4}} = \sqrt[7]{27}=1.601$$

the ratio of progression required, so that each speed above the lowest must be equal to the product of the one next below it and 1.601. The speeds thus obtained are 4, 6.4, 10.25, 16.4, 26.3, 42.1, 67.45, and 108. The belt is on the same step of the cone when the lowest speed 4, and the 5th speed 26.3, are obtained, but in the case of the former the back gears are used so that the ratio

$$\frac{26.3}{4}=6.575$$

is the correct back gear ratio. The ratio between the largest and smallest steps of the cone is found from the formula

$\frac{D}{d}=\sqrt{R^{n-1}}$ in this case $\sqrt{1.601^3}=2.257$.

Taking D as 20″, d would then be

$$\frac{20}{2.257}=8.86'', \text{ say } 8\tfrac{7}{8}''.$$

The intermediate steps of the cone are generally fixed by arithmetical progression, that is to say, the differences between the diameters of each adjacent pair of steps are equal. As in nearly all cases the cones on the countershaft and the machine are equal, we shall fix the speed of the countershaft for that condition. It is a very simple matter to obtain the countershaft speed when there is an odd number of steps in the cone, for it is then the same as that of the machine cone when the belt is on the middle step, but in the case we have been considering there is an even number of steps, and on inspection of the list of speeds it will be seen that the required speed lies somewhere between 42.1 and 67.45: the latter is 1.601 times the former, and if we extract the square root of 1.601 the ratio of progression, and multiply 42.1 by the number so found, we have the required countershaft speed.

$$\sqrt{1.601}=1.265 \text{ and } 42.1\times1.265=53.26$$

the proper speed. There is no need for mathematical niceties with these speeds, for it will probably be impossible to get the back gear ratio exactly as given here, but after settling on the gears to be used the actual speeds obtained should be calculated and compared with those got by the method explained. Some of the foregoing quantities are obtained by the use of the slide rule, and may not be absolutely correct in the decimal figures.

There are very many items of interest that might be discussed, but space will not permit. There are matters regarding which opinions differ widely, and many of the problems which the machine designer has to solve are such that he cannot find established data or even pure theory to work on, but there will always be room for a better understanding of the things that can be and have been proved.

A Heavy Vertical Milling Machine.

From what has been written, some idea can be formed of the methods in use in the drawing office of the Bertram works, Dundas. If any builder wished his machines to have have an individuality of their own, original and individual work must be done on their design, and it is only then that they will stand as the real product of the builder. A recent production of this old Canadian firm is a heavy vertical milling machine, two of these having been built for the American Locomotive Co., of Montreal. The necessity for extremely rigid tools in the locomotive shops is understood by many, and in this instance it was required to construct a machine more rigid than any hitherto in use. The general view of the machine reproduced from a photograph shows it to be of massive build, the frame being very heavy and stiff. Figs. 2 and 3 show the driving and feed mechanisms at the rear of the machine, and Fig. 4 shows the clamping device for the circular table. The drive is by means of a cone pulley of large diameter carrying a 6 in. belt. This pulley is secured to a long sleeve which runs in bearings in the main frame and projecting arm. On the inner end of this sleeve is secured what might be termed the cone pinion, and at the outer end are formed clutch teeth to engage with those on a clutch which can be slid on the shaft. Back gears revolving on a stud of large dimensions can be brought into use by means of a lever with locking latch, the clutch at end of sleeve being then disengaged. The cone diameters and back gear ratio are carefully arranged in accordance with the principles previously explained, so that a proper range of speeds is provided. The strengths of the teeth of the gears, which are all of steel, are calculated from the well-known Lewis formula, which allows a margin of safety greater than is found in many machine tools. The drive to the vertical shaft is by

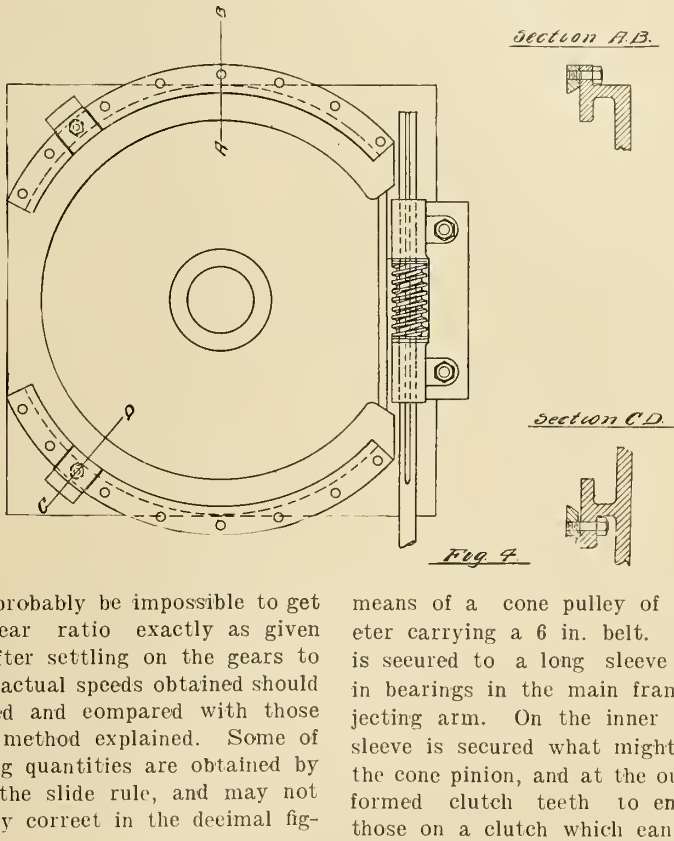


Fig. 4.

means of a pair of steel mitre gears, and from that shaft to the spindle, the spur gears appearing in the illustration form the drive. As the vertical shaft is of large diameter and considerable weight, a ball-bearing is provided under the pinion at the top of the machine.

The object of keeping the cone pulley well towards the base of the machine is to reduce vibration to a minimum, as with the high speeds now in use when a fast running pulley is at considerable height on a machine there is sure to be more or less vibration. The location of the drive renders it imperative to inquire closely into the stiffness of the shafts and spindle transmitting the power from the cone pulley to the milling cutter. In this connection it will be of interest to know that the result of the calculations made as has been fully described, shows that under full load the angle of torsion at the lower end of the spindle is only .23 degree, this heing the accumulated angle arising from the twisting of all the shafts. When it is known that a cutting force of 21,000 lbs. acting at the circumference of a milling cutter 5 in. diameter is possible, it must be seen how very rigid the drive is. The spindle runs in a taper bronze bearing at its lower end, and is balanced by a weight inside the frame, this weight also serving to balance the spindle slide, which can thus be easily operated by hand. Provision has been made for attaching a vertical power feed if desired.

The bearing surfaces of table and slides are proportioned liberally, and the circular table is well secured against any tendency to rise. In Fig. 4 will be seen the arrangement for this purpose with the clamps for holding the circular tahle when desired.

In order to facilitate quick handling, the worm which operates the circular feed can be readily swung out ot gear with the wheel and the table revolved rapidly by hand. The feeds are obtained by means of a cone pulley secured to the same sleeve as the driving cone, and the diameters of the steps of this pulley and the one on the shaft below are so arranged that this shaft has a constant speed, provided that the feed belt is run on the step corresponding to that on which the driving belt is at the time. On the inner end of the lower shaft is a pinion, connected through intermediate and tumbler gears to a large gear on the end of one of the feed box shafts. These tumbler gears permit of the feed being reversed. The construction of the feed box is very simple, there being three gear shafts, two being provided with clutches so that by different combinations of these two clutches four different feeds can be obtained. It happens that the feeds of this machine form a very simple illustration of geometrical progression, being $\frac{3}{8}$ in., $\frac{3}{4}$ in., $1\frac{1}{2}$ in. and 3 in. per minute.

It can easily be seen that the ratio of progression here is 2. Greater or less feeds can he obtained by varying the position of the belt on the feed cone, but such a change would be seldom, if ever, required. The longitudinal feed is transmitted through a high angle worm and wheel, mitre gears and a screw to the table slide, while the cross and circular feeds are operated by worm and spur gearing, as clearly seen in illustration. From what has been said in regard to screws and worm wheels, it will he understood that there is considerable loss in transmitting the power to the table, hut, notwithstanding this loss, there is pressure enough delivered by the feed screws to force the work against the cutter when the heaviest cuts are being taken.

No attempt is made to give a positive geared feed, as it would not be considered advisable. There is a growing feeling that an element of elasticity, either in a drive or feed, is a good thing, provided, of course, that there is power enough delivered for all legitimate purposes without any slip. Accidents will happen, and it takes less time and costs less to replace a helt than to fix up a few hroken gears.

The pump, of the gear type, for supplying a copious supply of lubricant to the work can be seen in Figs. 2 and 3, where the method of driving it will also be noticed.

BOOK REVIEWS

Modern Electric Practiee. Edited by Magnus Maclean, M.A., D.Sc., professor of electrical engineering at the Glasgow and West of Scotland Technical College, London. The Gresham Publishing Co., complete in six superroyal 8vo. volume, attractively bound in cloth. Price nine shillings net each volume. No other electrical work has yet been undertaken wherein the subject of electricity in its various applications has been treated in such a comprehensive manner. Besides the editor, thirty-four contributors, well known in the electrical profession, have united to produce this exhaustive treatise, which forms a complete encyclopedia of electrical knowledge. It is essentially practical and at the same time authoritative in every sense of the word. This set should appeal to all interested in any branch of electrical science or industry, whether as engineers, manufacturers, professor, chemist, student or amateur. In conjunction with this work, the publishers have issued an ingenious model of an induction motor, which shows the building and working of such a motor. The volumes are very fully illustrated, showing photos of detail of machinery, methods of construction, fittings, instruments, etc., and by diagrams, drawings and sections. It is the best electrical treatise we have seen.

Journal of the Iron and Steel Institute. Edited by Bennett H. Brough: New York, Spon & Chamberlain. This is a supplement to Vol. LXV of the Iron and Steel Institute, in which are discussed the relation between the effects of stresses slowly applied and of stresses suddenly applied in the case of iron and steel, and comparative tests with notch and plain bars. This is a purely theoretical treatise and takes up the subject in a comprehensive manner, subject matter being in a large measure gleaned from research work, carried out by one of the Andrew Carnegie research scholars..

Electrical Engineering Tests. By Geo. F. Sever and Fitzhugh Townsend. New York: D. Van Nostrand Co. Price $2.50 net. It represents a laboratory work required in the Electrical Engineering course at Columbia University. It is intended as a text book for students, but is practical in its scope and can be used to advantage by those engaged in commercial work. The theoretical principles of electricity are assumed on the part of the reader. Part 1 of the book is devoted to direct current tests; part 2 to alternating current tests, and part 3 to electrical measurement. This book has been introduced at a time when there was an urgent call for such a publication.

Reed's Guide to the Use and Management of Yacht, Trawler and Launch Engine. By J. D. Young, Sunderland; Thos. Reed & Co., Limited. 362 pages, illustrated by 12 plates and 120 diagrams. This book goes into the matter of marine machinery in an attractive manner, gradually leading up to the finished product, after dealing with the elements used in connection with operating such machinery, considerable space being devoted to boilers, the importance of which is not overestimated. Besides describing different makes and types, the management of such is fully discussed in a most practical manner, making this book a valuable one to all interested in marine machinery of any kind.

Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

DIRECT CURRENT MOTOR CONTROL

Motor controlling apparatus may be divided into two general classes, one for merely starting a motor and bringing it up to normal running speed, and the other for starting

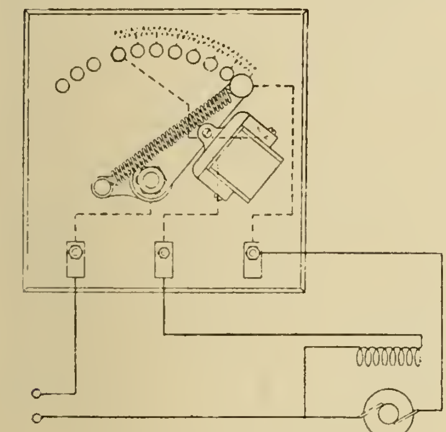


Fig 1. Field circuit always closed.

the machine and also regulating its rate of speed. The former class includes both manually and electro-magnetically operated mechanism, while the latter, excepting in very special cases, is restricted to purely manual operation. Simple motor-starting apparatus of the modern manually operated type is always provided with automatic means for restoring the movable member of the "off" or starting position in the event

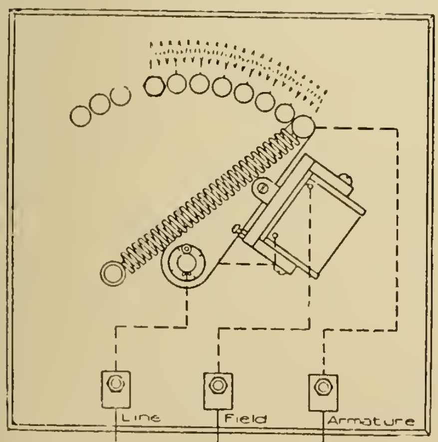


Fig. 2. Field circuit opened with armature circuit.

of the failure of the supply current. The apparatus itself comprises a series of resistance coils which are put in series with the armature when the circuit is first closed and then gradually cut out by means of a brush mounted on the free end of a swinging arm and arranged to sweep over a row of stationary contacts connected to the resistance coils. This type is familiar to everyone at all experienced in motor operation. The automatic release consists of a small magnet which is energized as long as the circuit is intact, and which holds the starting arm in the full-speed position; cessation of the supply current de-energized the magnet, of course, releasing the arm, and a spring returns it to the starting position.

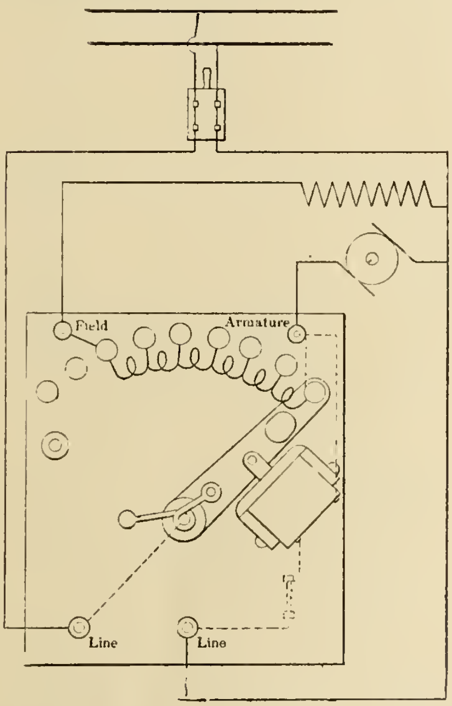


Fig. 3. Field circuit always closed. Release magnet across line.

Fig. 1 shows a common arrangement of the release magnet, and the other parts of the starter. The release magnet is connected in series with the shunt field magnet winding of the motor, and the starting resistance when the arm is in the full-speed position, as shown in the diagram; the object of this method of connection is to keep the field circuit always closed. At the first step of the starting arm, the shunt field and release magnet are excited and current is admitted to the armature through the complete starting resistance, and as the resistance is gradually cut out of the armature circuit, it is cut into the field circuit its resistance is so small, however, in comparison with that of the shunt field winding that the drop, when

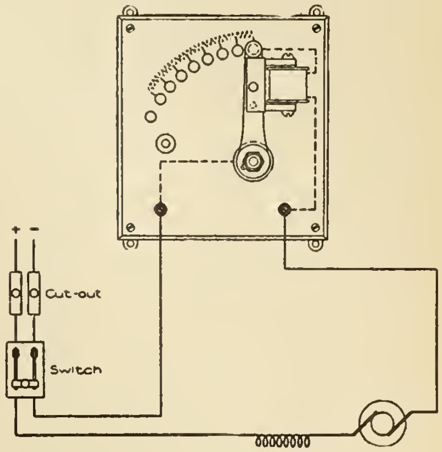
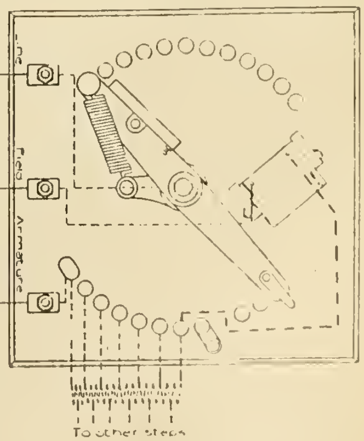


Fig. 4. Usual connections for series motor.

only the shunt field current is passing through it, is considerable.

The arrangement shown in Fig. 2 was formerly used exclusively, but it has been superseded in many cases by the connection shown in Fig. 1 which is usually preferable because large motor field magnets do not always lose their magnetism sufficiently, before the release magnet lets go, to avoid an objectionable inductive flash when the swinging arm opens the field circuit by



No. 5. Starting resistance, showing number of steps

leaving the first starting button as it is thrown back to zero by the spring.

Fig. 3 shows still another method of connecting up the release magnet; here

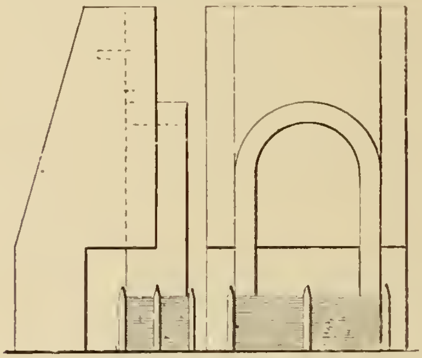
it is connected across the line in series with the starting resistance when the arm is in the running position, as shown in the diagram. This arrangement has the obvious advantage that the magnet is sure to receive full excitation regardless of the character of the shunt field winding of the motor, while in the other cases a shunt field winding of unusually high resistance might take insufficient current to make the release magnet hold the starting arm reliably; in practice, however, this is a matter of rather remote contingency, since the release magnet can readily be designed for reliable operation with a current smaller than the field winding can possibly be excited with, and still have radiating surface sufficient to enable it to carry the largest current that any normal field will require.

For series motors, the common arrangement is shown in Fig. 4, which requires no explanation. In this case, it is not so important to maintain the field circuit, closed after the motor is disconnected from the supply circuit, because there are not nearly so many turns in the winding and the inductive e.m.f. due to the discharge of the field magnetism is not high enough to do any damage.

In Fig. 5 the starting resistance is divided into a large number of steps by the addition of another row of contacts interconnected as indicated. The swinging arm carries an auxiliary finger which is pivoted to the end of the arm, and makes a quick snap break when the arm passes the upper button of the right-hand row, on being thrown back to "off."—American Electrician.

TESTING STRENGTH OF MAGNETS.

IN manufacturing electrical instruments it was found that there were no instruments that would measure or indicate the strength of permanent magnets. For that purpose a rig, shown in the illustration was fitted up. This rig consisted in the use of a number of very light weights, in the form of pieces of the thinnest iron that we could find, shaped so as to practically cover the two ends of the magnets, and made as flat as possible, so that they would pack together closely. These weights were numbered consecutively from one up, the figures being stenciled in white, and as large as the size of the weight would permit, so as to be plainly seen. In use we piled them up inside some pins set in a board, as shown—simply to hold them in position—the top weight always being No. 1, the numbers increasing consecutively to the bottom of the pile. A guide was arranged so that the magnet when placed therein could be raised and lowered and kept in correct position on striking the weights. To get the strength of a magnet, we placed it in the guide, allowed it to slide down so that its ends rested on the pile of weights, then raised it up and noted how many weights it lifted. Suppose it lifted ten of these weights, we marked this particular magnet 10, and put it in a box marked 10. The next magnet tested might lift a greater or less number of weights—say twelve—and was so marked and put in a box marked 12, etc., etc. In this way each box contained magnets of practically uniform strength. This enabled us, while assembling the instrument, to be sure that all magnets in it were uniform in strength. We soon found out the limits that could be used, and had no further trouble on this point.—Am. Machinist.



How the magnets were tested.

THE VALUE OF THEORY.

THAT the electron hypothesis is weakening faith in some of our most cherished theories of electrical action cannot be denied: and the time-honored tenets of magnetism are now subject to challenge as a consequence of the researches in non-ferric alloys by Fleming and Hadfield. In view of this condition, which may be distributing to the minds of those who do not properly recognize the real function of theory, it is well to remember that established theory should never be held as an article of faith—as is too often done when connected with names of high authority—but considered only as an acceptable generalization on all the facts in existence coming within the range of the theory. To hold any theory is an ultimate explanation of any set of phenomena implies that every fact relating to the phenomena is known—that nature has nothing more to reveal. It is, moreover, a condition of the growth of human knowledge in any department of science that whereas the advance never ceases in the acquisition of facts, yet the interpretation placed upon series of facts may vary markedly from time to time. The wealth of acquired material does not shrink, but always advances, sometimes rapidly and at other times more slowly. Nevertheless, the theories embracing the facts, and attempting to explain them, often wax and wither in a single decade. It might really be questioned whether in view of the history of mortality in theories it were worth while attempting to find a theory to fit observation, and whether it would not be better to go on accumulating new materials of fact, heedless of their theoretical relations. The value of theory is, however, that it co-ordinates, or at least seeks to co-ordinate, the facts so as to permit of their proper grouping and presentation in natural sequence. Without the aid of theory knowledge would constantly become more difficult, by accumulation; whereas, with the aid of theory, knowledge may actually grow easier to acquire, from age to age, in spite of the constant accumulation of material.—El. World and Eng.

TELEPHONE INFECTION.

THIS seems to be the age of germ diseases. Every human ailment is attributed to some minute organism which, for the moment, has assumed an unusual activity, with detrimental consequences. Many diseases are believed to be spread by these germs, which are supposed to attach themselves to every object used by the afflicted person, and there wait for an opportunity to seize upon a new victim. One of these objects sometimes held in suspicion is the telephone, particularly the public instruments which are used by everyone. To see whether there is any truth in this matter, a recent examination was made in London, England, of a number of telephone instruments taken from public booths. These were carefully washed, and the water examined bacteriologically. Though the instruments were very dirty, no germs were found. The washings were then used to inoculate four-footed pigs, the two-legged variety not offering itself for the experiment. We are happy to say that the guinea pigs suffered no ill from the test. As these instruments were taken at random, and had doubtless been used many times by affected persons, the result should allay somewhat the anxiety of those who feel uneasy when using a public telephone.—El Review.

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

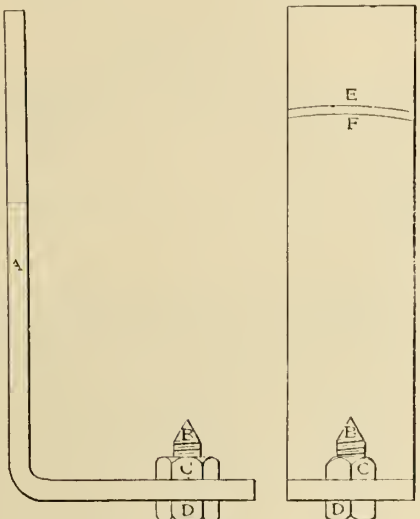
TESTING TWIST DRILLS.

THE sketches show a very simple and effective device for testing the accurate grinding of twist drills. Although there are efficient machines on the market for grinding twist drills, it is sometimes done very carelessly, especially if the operator is a young boy, which is generally the case. I see cases nearly every day where work is scrapped through the inaccurate grinding of drills, although the majority of them are provided with "grinding lines" to serve as a guide to grind them centrally.

A is a piece of mild steel about 18 inches long, 1½ inches wide and ¼ inch thick, bent to the shape shown in the side view. A ⅜-inch clearance hole is drilled through the bottom to receive the screw B, which has a long, sharp centre turned on the top, and is held in position by the two lock-nuts C and D. The drills to be tested after grinding are pivoted on the centre B, which rests in the centre hole in the tapered end of the drill. The two extreme cutting corners of the business end of the drill are then drawn across the bar A, which is rubbed with white chalk. If two marks are made—the same as E and F, the drill is not ground correctly. If both the cutting corners follow in exactly the same line, the drill is ground correctly.—American Machinist.

THE QUESTION OF THE GAS TURBINE.

AN answer to the question "why not a gas turbine?" is here given by Professor Sidney E. Reeve. The author first shows why the steam turbine promises to displace the reciprocating engine, and then points out that the same conditions do not obtain in gas-engine practice. The prime problem of steam-engine design, from the days of James Watt, has been to reduce or prevent cylinder condensation. On the other hand, in a gas engine there is no condensation; and on account of the high temperature, we are forced to cool the cylinder rather than heat it. The steam turbine has made possible a desirable increase in rotative speed, but to employ high-temperature, high-pressure gases efficiently directly in a steam turbine will call for speeds far too great. Nevertheless, Professor Reeve believes that the development of a gas turbine is a desirable thing. As to the practicability of the gas turbine, two phases of the development must be considered. The author shows that the cycles commonly used in reciprocating gas engines cannot be applied to the turbine. If the gases are admitted directly into the turbine, the temperature is too high. If expended simply in a nozzle the velocity is too great. To get around these difficulties the gases may be mixed with steam. Thus not only will the temperature be reduced, but the weight of the fluid will be increased, and hence the velocity of exit under any pressure decreased. This process would overcome not only the thermodynamic, but the mechanical difficulties. The conclusion is reached that the gas turbine is a machine immediately practicable both thermodynamically and mechanically, with the sole exception of the question of the best method of forcing the fuel and air into the generator.—Engineering Magazine.



Simple device for testing the grinding of twist drills.

SUPERINTENDENTS SHOULD NOT ACT AS WORKMEN.

IN an address before the recent Chicago convention of the Master Steam Boiler Makers' Association, Robert Quayle, superintendent of motive power of the Chicago & Northwestern Railway Co., speaking to an audience of superintendents and foremen, said: "You men have no business to have your coats off when on duty in your shops unless you are warm. You have no business to take the tools out of a workman's hands to do his work. Your business is to secure results from other men's work. If I find that a foreman boiler maker on my road is doing the work that his men ought to do I begin to think that he had better keep using the hammer and chisel."

This utterance, which will be taken as a heresy by many an old-time master boiler maker who obtained his mastery mainly by superior physical strength and endurance, embodies a truth of vital importance to men whose duty it is to direct the labors of others. A man cannot work with his hands and at the same time give intelligent supervision to a gang of men, and a foreman who does this is apt to lose the control of his men while he is weakening the confidence of his employers in his ability as a general. The best workman is not always fit to be promoted to a foremanship, though a foreman or superintendent is better for knowing how to do and do well every task of every one of his men. In battle the officers are not expected to aim and fire with their men. They carry only side arms and this is for self protection in an emergency.

The proprietor of a business who expects his foreman or superintendent to do a day's labor in addition to his supervision of his men has the wrong idea of economy, and the foreman or superintendent who will regularly do manual labor has better zeal than judgment. The manager who so little trusts his subordinates that he burdens himself with a hopeless mass of details of the $10 a week quality foredooms his failure and probably shortens his life. The successful proprietor or superintendent or foreman sees to it that he has enough men of enough skill to carry on his work, and devotes his own energies to watching, correcting and directing these men, always keeping for himself enough time for the broad study of the general welfare of his business. The large salaries of to-day go to the mentally alert rather than the manually dexterous. Generalship will always receive a larger reward than mere marksmanship or marching endurance.—Iron Age.

ROPE TRANSMISSION.

TRANSMISSION of power by manila rope has a recognized field when the distance between the driver and the driven is comparatively great, or the amount of power to be transmitted is large.

Among its advantages may be mentioned its convenience in application, first, cost of maintenance, alignment,

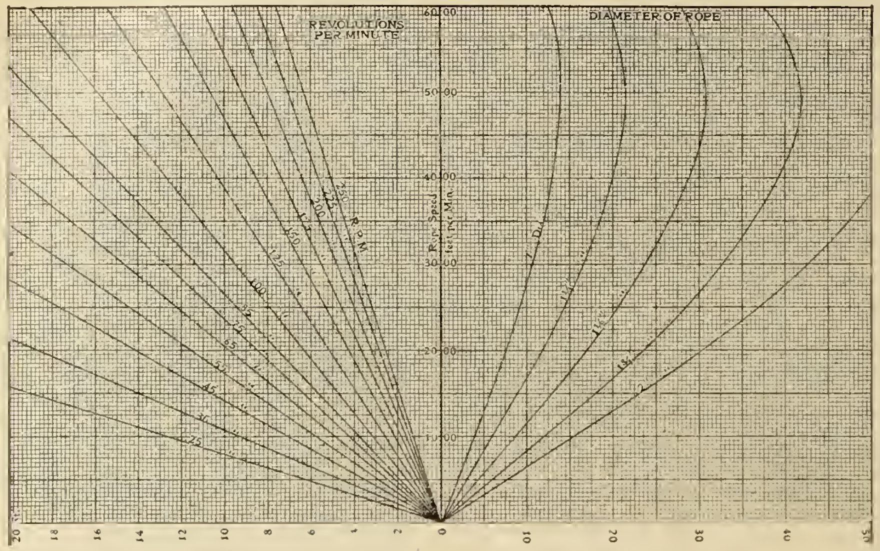
compactness, positive and regular driving, freedom from slipping, transmission of power in any direction and at different distances, and in different planes, and the multiple driving of several shafts.

In the design of a rope-drive system, attention should be paid to the method of reeving the rope, the amount of tension, the working strain in the rope, the diameter of the sheaves, the chafing of the coils upon each other, the velocity of travel, the spacing of the idlers and the shape of the grooves.

Most of the above points are determined by design conditions, or are based on good practice, so that the problem ultimately resolves itself into a determination of the size and number of ropes to transmit a given horse-power, using a driving wheel of an assumed diameter driving at a fixed number of revolutions.

At this stage in his calculations, the designer turns to catalogues, engineering hand-books and text-books for information, only to be confronted with formulas in terms of the safe working stress in pounds per square inch, ultimate breaking strain in pounds; the tension in the driving side of one rope in pounds; the tension in the slack side of one rope in pounds; the working force in one rope on circumference of pulley in pounds; centrifugal force in pounds, gravity, sag of rope, distance between shafts, velocity of rope in feet per second; weight of rope per foot, etc.

What he really wants to know is, how many ropes of a certain diameter will transmit his horse-power with the size of driving wheel which he has selected and running at the speed of his engine or motor. The attached diagrams are designed to short-cut these calculations, giving the essential values, and at the same time showing relative values, so that other combinations can be selected at a glance.



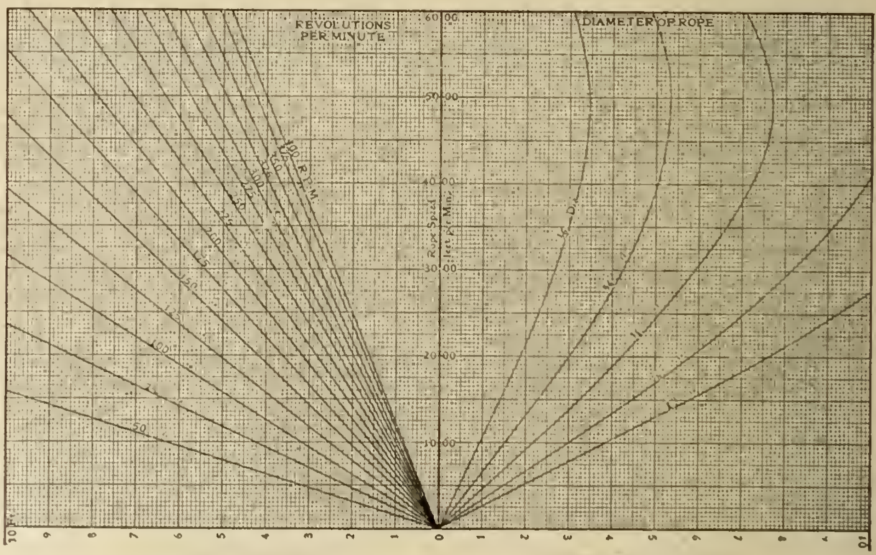
DIAMETER OF ROPE WHEEL — HORSE POWER TRANSMITTED PER ROPE

The data is compiled from tables issued in an engineering hand-book, consideration being given to centrifugal force where the speed is greater than 2,000 feet per minute, and 6,000 feet per minute is taken as a limit of good practice. In the upper diagram, diameters of pulleys are shown up to 10 feet designed for $\frac{1}{2}$, $\frac{3}{4}$, $\frac{7}{8}$ and 1-inch ropes, with a maximum velocity of 6,000 feet per minute as good practice. In the lower diagram diameters of pulleys are shown up to 20 ft., designed for 1, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, and 2-inch ropes, with a velocity of 6,000 feet per minute as good practice. In order to use the tables, select the diameter of the pulley desired, follow upward until the revolutions are read, thence across to the right to the diameter of rope selected, noting whether the rope speed is less than 6,000 feet per minute, and directly under the diameter selected, the horse-power per rope will be given.

If this horse-power is known, then the intersection of the rope velocity with a vertical line from the horse-power will give the proper diameter of rope.

To find the horse-power transmitted by a rope of $\frac{5}{8}$-inch diameter, for instance, running over a 5-foot pulley which is revolving at 175 revolutions per minute, follow the vertical line through the 5-foot line until it intersects the diagonal line representing a speed of 175 revolutions and then follow the horizontal line through the intersection until it intersects the curved line representing a $\frac{5}{8}$-inch rope. On following the vertical line through this point of intersection down to the right-hand horizontal scale, it is seen to intersect it at a place corresponding to 4 horse-power.

It is quite evident that if any three of the four variable quantities given in the diagrams, viz., diameter of rope wheel, revolutions per minute of rope wheel, diameter of rope and horse-power transmitted, are known, the one unknown may be read directly from the diagrams. Thus, if it is desired to find the size of a rope necessary to transmit a certain horse-power, it may be found at the intersection of the lines through the horse-power and that through the speed corresponding to the pulley diameter and its velocity. Rope is made in certain commercial sizes, so that if the size necessary lies between these standard sizes, the next larger size than the one indicated should be used.—Power.



DIAMETER OF ROPE WHEEL — HORSE POWER TRANSMITTED PER ROPE

MACHINE SHOP PHILOSOPHY.

A junk shop is all right in its place, but its place isn't in a machine room.

Nobody but a 'prentice boy and a lazy mechanic will stand at a vise and pound cold iron.

Many a man loses a good job by continually looking round to see if the boss sees him working.

It's a notorious fact that 9 out of 10 unsuccessful machinists believe that they can make farming pay.—The Draftsman.

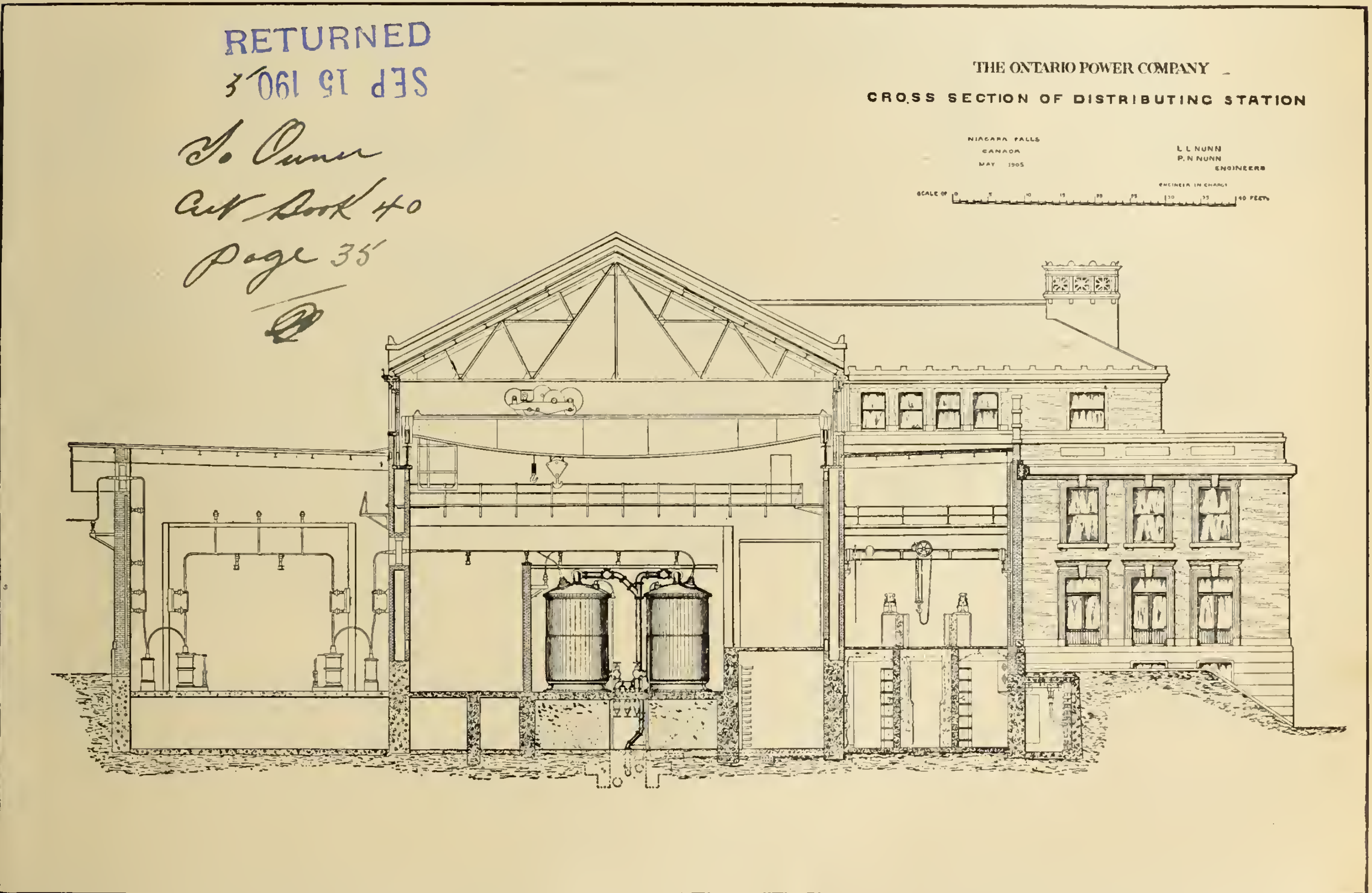
The Development of The Ontario Power Co.*

(By P. N. Nunn.)

THE plan of power development adopted by the Ontario Power Co. differs considerably from that adopted by the other two companies on the Canadian side, the Electrical Development Co. and the Canadian Niagara Power Co. The purposes and methods followed in the development of the pioneer plant and the environment and natural conditions at Niagara Falls have become so well known that interest of this development naturally is centered in its salient features or in those most likely to representate advance in engineering. The chief of these are the arrangement of the intake-water, the design of main conduit and spillway, the horizontal shaft units, the symmetry of arrangement, the centralization of control, and the protective isolation of apparatus.

One may observe at the foot of the cliff forming the right hand wall of the gorge, a long, but unobtrusive building, the end nearest the falls obscured by the spray from the great cataract. It is massive in design, and its colors almost blend with those of the overhanging cliff. This is the generating station of the Ontario Power Co. The distributing station is on top of the bluff overlooking both gorge and cataract. Here the power generated below is controlled, measured and transmitted. Away to the left around the bend of the river lie the walls, abutments and buildings of the intake and head-gates. From the head-gates three great steel and concrete conducts, beneath the surface of the park, will convey nearly 1,200 cubic feet of water per second. Thence it will pass through 22 steel penstocks in shafts and tunnels down and out through the cliff tunnels to an equal number of horizontal turbines in the power-house below. From the generators the electrical cables turn back through tunnels to the 22 banks of switches, transformers, and instruments of the distributing station above, and to transmission lines beyond, completing an equipment for more than 200,000 h.p.

The intake-works for the entire 200,000 h.p. are now finished. One of the three main conduits is completed, while for the second and third, portals and head-gates have been installed and a portion of the excavation made. Six of the 22 penstocks are already in place within their shafts and tunnels, and two others are building, while the power-house is nearly prepared for the concomitant apparatus. The distributing station is ready for the switchboard of the entire 22 units, for the transformers of eight, and for other apparatus of 14.



The Intake-Works.

The intake-works have been located and designed with especial reference to the ice difficulties which have been the limiting factor in the success of Niagara power. To avoid the mush ice formed

*Read at the 22nd Annual Convention of The American Institute of Electrical Engineers, Asheville, N.C., June 19, 1905.

in the rapids, the intake is located in the smooth but swift water just above the rapids; to exclude the cake ice, the following features have been introduced. A long and tapering forebay is constructed, protected at the entrance by the main intake terminates at its narrow, down-stream end in a deep spillway. Upon the river side it is enclosed by a submerged wall, while the other side adjacent to the spillway is occupied by the main screen structure leading to the inner bay and to the portals and head-gates of the three conduits.

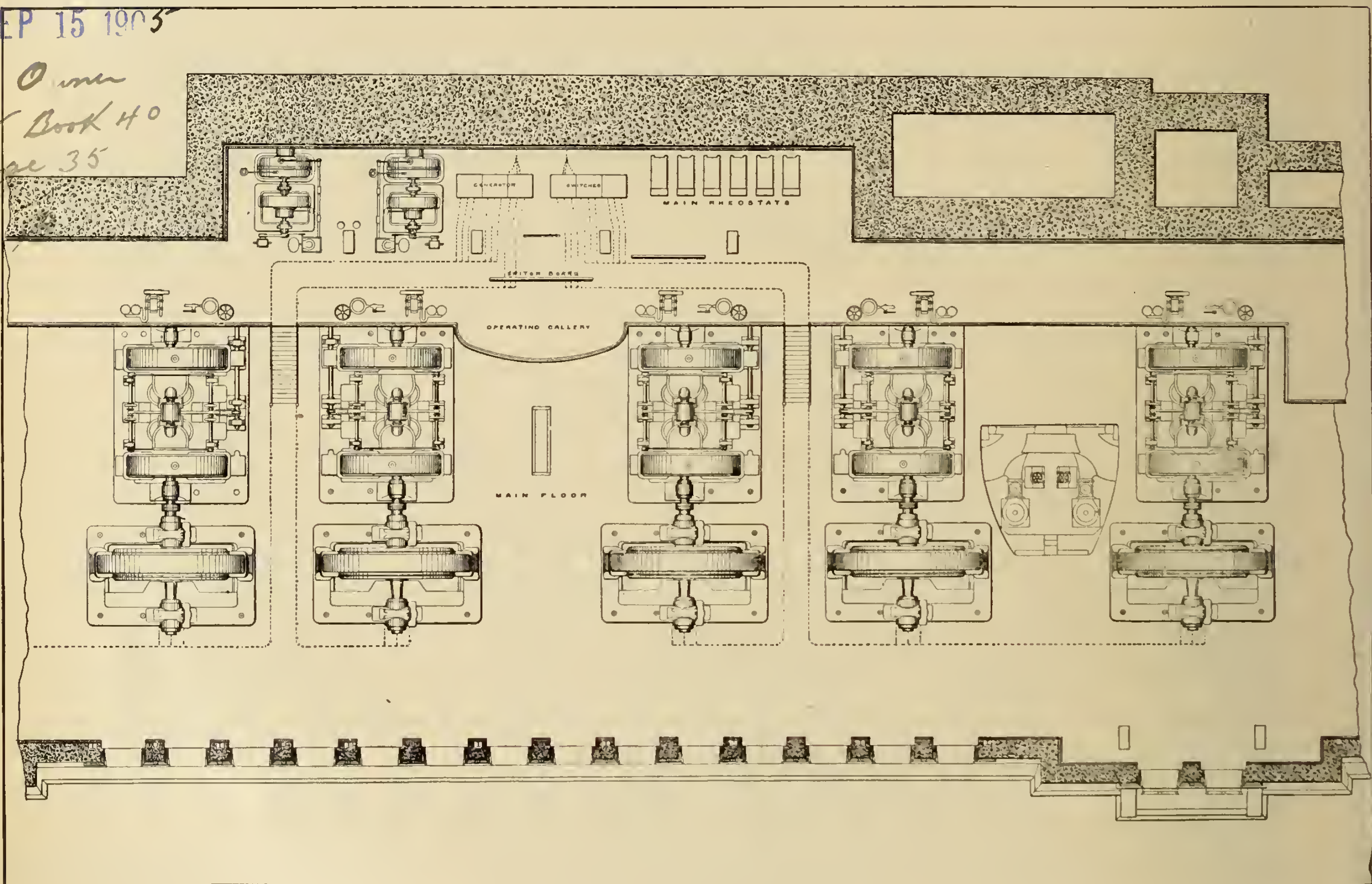
The intake, nearly 600 feet long, stretches across the inlet or bay at Dufferin Island, almost parallel with the current in the river. Throughout its length a concrete curtain-wall extends down nine feet into the water, here 15 feet deep, so that the gate openings beneath admit only deep water, and this at right angles to the swift exterior surface flow which, sweeping the full length of the curtain, carries the floating ice to the rapids beyond. At the main screen this operation is repeated. This structure, 320 feet long in 20 feet water, lies across the entrance to the inner bay and parallel with the direction of flow in the outer bay. Again a curtain, formed by the front wall of the enclosing superstructure, admits to the screens only deep water, here also at right angles, while it excludes ice with the surface currents maintained through the forebay by a voluminous spill of surplus water.

At the gate structure, where the water is 30 feet in depth, the tapering portals leading to the electrically operated Stoney head-gates are protected with wide-mesh screens, which are also enclosed and safeguarded by a curtain carried by the front wall of the gate-house. The bay in front of the curtain communicates with the river by an ample ice-run. Substantial concrete buildings shelter both head-gates and main screens. In each case an open canal between curtain and screen spills into a gravity ice-run emptying into the river. Both buildings are supplied with steam for heating and thawing from an underground boiler plant situated in the common abutment.

Thus the water before entering the conduits must pass in succession three automatically selective steps, each excluding surface water and its floating ice, and two screens, each behind ice-runs in heated buildings containing live steam for emergencies. Serious trouble is not believed possible while these provisions are maintained with reasonable care.

Construction of Conduits.

The main conduits are of 0.5 inch riveted and reinforced steel, imbedded in concrete, 18 and 20 feet in diameter, 6,500 feet long, and are buried within the rock and soil of the public park. Through them the water flows at a velocity of approximately 15 feet per second. Just beneath the top of the cliff behind the power-house, within a long underground chamber, the arched roof of which supports the conduit above, 9 feet diameter branches pass from the under side of the conduit through gate-valves and become the penstocks, each supplying water at 10 feet per second to a single turbine. Each penstock has two expansion joints, a massive thrust anchorage in the power-house foundations, and an automatic relief-valve and a stone-catch discharging into the river. The 9 feet valves are electrically oper-



Plan First Section of Generating Station.

ated under distant control from the power-house below, and are so constructed that all working parts may be removed for attention while the penstocks are in service.

There is a spillway at the end of the conduit to prevent water-hammer in case of sudden loss of load.

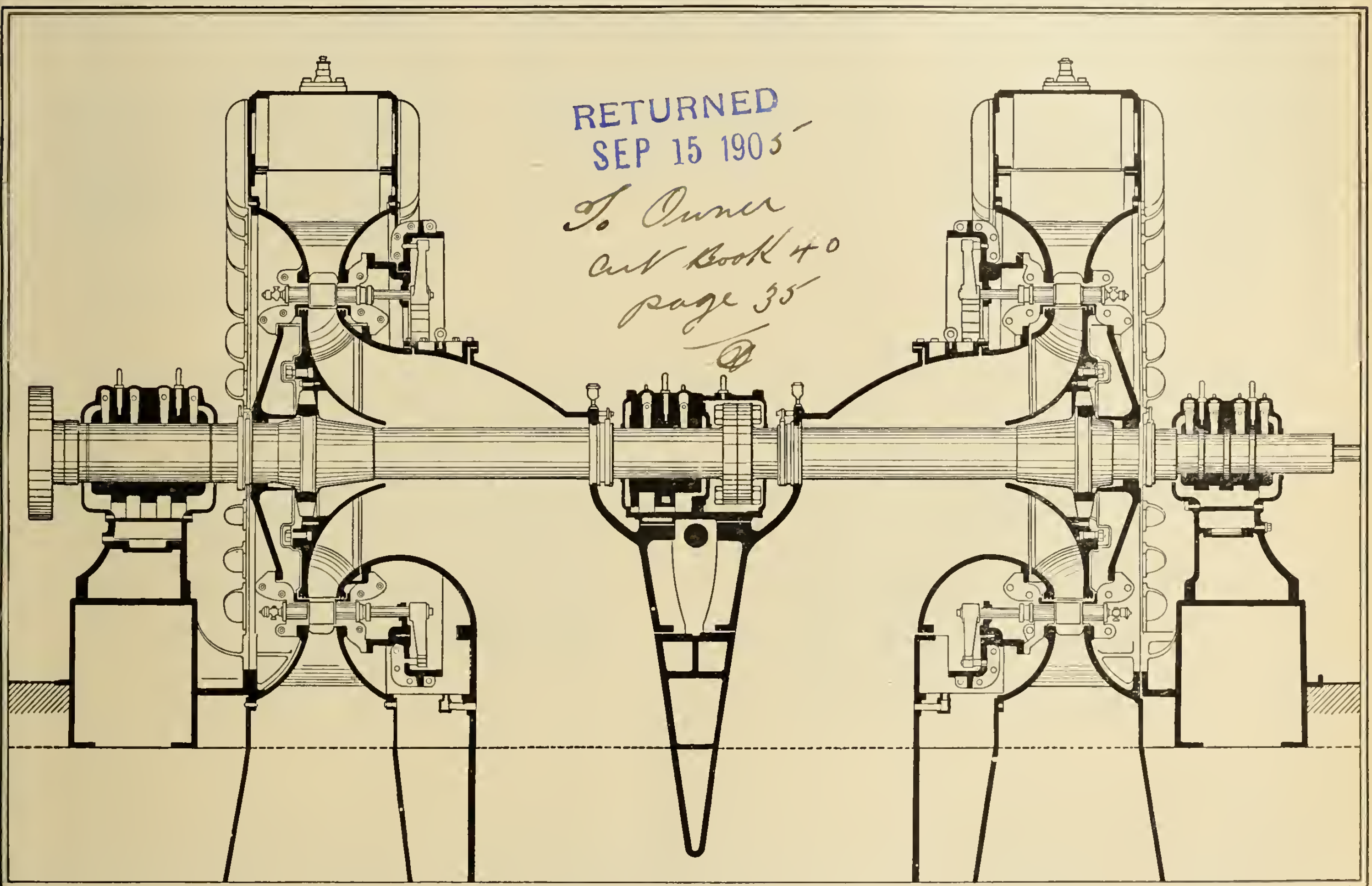
Power-House Equipment.

The generators are of conventional horizontal shaft type, three-phase, 25-cycle, and deliver 12,000 volts at 187.5 rev. per min. The turbines are of Francis or inward-flow type, double, central-discharge or balanced twin turbines designed to deliver 12,000 h.p. under 175 feet head. Their shafts are 24-inch maximum diameter and each carries two 78 inch cast-steel runners of "normal" reaction. Housings are of reinforced steel plate, 16 feet in diameter, spiral in elevation and rectagular in plan. Gates are of the wicket or paddle type, and the rotating guides forming them are carried by shafts which project through stuffing-boxes of an external controlling mechanism, thus freeing the casings from the objectionable interior gate-rigging and leaving its approach to the guides symmetrical and open.

Of the 175 foot head, 20 feet is in the 10 feet diameter draft-tubes, because the floor of the power-house has been elevated 26 feet over mean water level to provide for the excessive variations to which the water in the gorge is subject. While bearings are self-oiling, all are equipped with water-cooling system, and for still greater insurance a piping system for the changing of oil has been so connected that in emergency it is instantly available for forced lubrication. Each bearing is supplied with an automatic record-making thermometer, providing the superintendent with a daily record of the temperature of the bearing.

Although entirely feasible to use the vertical-shaft turbine and although restricted space at the power-house requires greatest floor economy, nevertheless horizontal units are employed on account of their freedom from step-bearings, their higher efficiency, and their greater accessibility. While step-bearings in certain places are entirely successful, as long since proved by screw propellers and more recently by vertical steam turbines, yet at best they entail much auxiliary apparatus requiring especial care and frequent adjustment. With high-head turbines they have an uncertain record to be shunned wherever continuity of service is essential.

Gratifying accessibility has been obtained by compact arrangement of generators and turbines with ample clearances and good light, upon the main floor of the station and in full sight not only of the immediate attendant, but also of the chief operator from his post upon the gallery above. As explained, the entire gate-rigging is external, therefore, accessible for lubrication, adjustment, or repair. Excepting runners and gates, every moving part is in plain sight and, by the ready removal of a single ring, even the guides themselves are exposed for cleaning or replacing. This arrangement, in strong contrast with that of the vertical type with its several floors, intervening stairs, and dark corners, will, it is believed, appeal to every power-house operator.



Section Detail of Horizontal Turbine.

General Arrangement of Works.

In the general arrangement of the works, symmetry and centralization of control are predominant characteristics. The generating and distributing stations are parallel and nearly 600 feet apart with 260 feet difference in elevation. On account of limited space the generating station is but 76 feet wide, though when completed it will be nearly 1,000 feet long. Down the centre of this building, side by side in a single row, stand the generating units with turbines next their source of supply. The space between them and the rear wall is occupied by a gallery upon which stands the row of oil-pressure governors, each almost over the end bearing of its turbine.

The distributing station, wider and shorter than the power-house, is divided into three longitudinal bays or five main sections. The narrow front bay contains the switches, busbars, etc., at generator pressure. Between these stretches the main middle bay divided transversely by a three-floor switchboard section into two long transformer-rooms. The projecting central section provides space for operating offices. Along the centre of these two rooms the transformers stand in groups of three corresponding in position and capacity to their respective generators. Thus similar apparatus is arranged in rows parallel one with another and with the generating units.

Arrangement of Power Cables.

At the generating station three inclined cable-tunnels, one already built, carrying clay ducts, begin at the rear wall beneath the gallery and extend up through the cliff and, as standard subway, on to the distributing station. The main cables, except as diverted by these tunnels, follow the shortest and most direct routes from generators to transformers. They do not converge for the accommodation of switchboard at one or more centres where congestion, which in many installations causes the most disastrous accidents, prevents separation or adequate insulation. On the contrary they are laid quite regardless of switchboard, the switches and instrument tranformers of which are placed as required by the cables.

Unit values, coresponding to the generators in capacity and position, are maintained throughout. Thus each generating unit has its individual cables, switches, and switchboard, section of bus-bars, transformers, interrupters and high-pressure switches complete to the transmission, enabling its independent operation as an isolated power-plant or, through the selector-switches and duplicate sectional bus-bars the operation of all units in any combination of groups as readily and perfectly as their operation in parallel.

Where the cable tunnels commence, the power-house and gallery are widened toward the cliff. Immediately above the tunnel entrance are the main generator switches, and on one side the duplicate turbine-driven exciters and their governors, and on the other the motor-actuated main field rheostats. In front of the switches, controls for actuating penstock valves, and the necessary circuits and apparatus for a limited local distribution. Relief-valves and small drainage-pumps are the only operating machinery beneath the main floor, while upon it, in addition to the generating units, there are only duplicate electrically-driven pumps supplying the storage-tank and transformer cooling- coils at the distributing station. For air circulation and ventilation and to avoid dampness from spray as well as to insure cool generators in hot weather, a cold-air supply to each generator is provided from a sub-floor chamber communicating with external shafts and heated air escapes through large roof ventilators.

At the distributing station the low-presure bay contains upon the main floor the 12,000-volt automatic oil circuit-breaker in double column and, in the chamber beneath, on the sectional duplicate bus-bars and their immediate connections. In the transformer rooms the transformers stand in pits six feet below main floor level, and parallel with them adjacent to the high-pressure bay are corresponding pits for static interrupters or other protective apparatus. Beneath both and between their foundations are accommodated the several systems of water, oil and drain-piping, and the main cable-ways to the transformers above. Each transformer is fitted with a record-making thermometer giving the continuous history of internal economy.

The switchboard section occupying the centre of the distributing station, has four floors, of which the basement serves as a centre for the piping systems and gives room for conduits and cableways for wiring. On the main and the mezzanine or gallery floors, marble slabs carry record-making and integrating instruments, terminal boards with fuses for control cables, and other adjuncts of the switchboard above. Upon the upper floor is the switchboard and control-chamber, and here instrument-stands and control-pedestals supplant both the conventional marble slabs and the later bench-board. Each of the 22 instrument-stands, which are arranged approximately in a semicircle about a central point, corresponds to a definite unit, carries nine indicating instruments, and faces its 12-point control-pedestal. Doors upon the four sides lead to balconies in the four other divisions of the building of which this room is the centre; those at the sides to balconies extending the full length of the transformer-rooms.

Centralization of Operation.

Centralization of responsibility and authority, at defined points within the immeriate personal care of a minimum number of chief operators, is, next to simplicity of arrangement, the prime requisite of efficiency of organization and of economy of operation. It is frequently possible so to arrange small plants of a few units as to centralize at a single operator, but with plant of this scope that result is manifestly impossible. Two alternatives are then open; the division of the plant into several parts, each about its sub-centre constituting virtually a complete plant in itself and the whole dependent upon successful co-operation for unity of result; or classification and centralization of responsibility according to kind. In this case the latter has been adopted, and notwithstanding that the number of units and aggregate of power involved have opposed high merit in this respect, a promising result has been obtained.

The concentration within a single room of all instruments and control—the brain of electrical operation—provides the operator in a quiet and secluded place, both full information, and perfect control of every electrical circuit and situation of the system, and enables him to stop, start, regulate, or synchronize each unit; to throw its output through its transformers to its transmission as if from a complete isolated plant, or to throw it upon either bus-bar while supplying its transformers from the same or the other bus-bar. The location of this room, high up at the geometrical centre of the distributing station, places the operator at a point of vantage surrounded by four classes of apparatus. Thus located he may with few steps survey his entire field; look down upon switches, bus-bars, and arresters of the high-tension; see at a glance every low-pressure switch, or watch trouble in either transformer-room.

(Concluded in next issue)

With the Canadian Manufacturers' Association Excursion Party in England

Messrs. McNaught, Ballantyne and Firstbrook discussing weighty affairs on shipboard.

Excursionists taking the electric cars at Sheffield.

Colonel Gartshore of London and Lloyd Harris of Brantford "on a toot" up the Thames.

Mr. Tobin and Mr. H. P. Allen and Son of London taking it easy.

A group of Winnipegers at the Ascot races.

Mr. and Miss Sweet taking it easy. Mr. Sweet is Manager of the Sanford Clothing Co., Hamilton.

R. C. Wilkins of Montreal and Mr. McDonald of London taking a sun bath.

Mr. and Mrs. David Waterous of Brantford playing Shuffleboard.

Construction and Improvement

General Construction *Contractors' Supplies*

THIS YEAR'S BUILDING BOOM.

ALL signs have favored the expectation that the present year will witness great, if not record-breaking, activity in building construction. Of course, it is hard—in fact, well-nigh impossible—to set definite limits to the total expenditure in this line in the country as a whole. The reasons for this are obvious. Municipal statistics, except in a comparatively few exceptions, are naturally vague. Even where, as in the case of the larger cities, there is a registry of the building permits and estimated cost of construction, there is the doubt, first, as to the statistical accuracy of the detailed estimates and, second, as to the ultimate carrying out of the entire volume of the work planned. There is the highest authority, for instance, for the statement that in some wide areas only two-thirds of the work projected for one year is actually carried out in that period. Then, again, there is the possibility always that widespread labor troubles may not only discourage possible building, but may actually check or hold up work upon which more than the initial steps have been taken.

Despite these drawbacks, however, there is a natural desire to set some measure to the probable scope of building activity in this country during the ensuing year. Bradstreet's has, therefore, endeavored to take steps to this end, and, while making the fullest allowances for all these diverse influences and drawbacks, a conscientious effort has been made to get a line on the proportions of 1905 building. The results obtained indicate an expenditure of $445,000,000 in 108 cities and towns in the United States, the returns being necessarily partial and not entirely conclusive of possible later special development, but are, nevertheless, indicative of a decided drift toward activity in all kinds of construction during the present calendar year. It is estimated that these figures cover only about three-fourths of the buildings being erected, the total being figured at $600,000,000 for the entire States.

A fair estimate of the cost of an average building is probably 40 per cent. for material and 60 per cent. for labor; but if half is allowed to each of these items, a total of $300,000,000 for material, such as lumber, brick, stone, iron, hardware and paint is possible, and a like sum must be credited to labor.

Canada's building development is even greater than that of the United States, the development in the larger cities and the western districts being marvelous. The putting into circulation of the vast amount of money as a result of this activity is bound to be felt by all sections of the community, but by none so much as the hardware trade, which now supplies the major portion of the articles called for in the construction of modern buildings.

STEEL-FRAME BUILDINGS.

CRITICS of the modern "sky-scrapers," with their frowning steel frames, have predicted that these lofty buildings will be short-lived, and that they are all destined to crumble away. The steel skeletons of these structures are mostly hidden from observation, and no one can tell whether they are intact or rusting away, but experts conclude from examination of the frame of one that has recently been demolished in New York, that such fears as those mentioned are groundless. In this building, which had stood four years, the only rust in the frame was that acquired during construction, and it is concluded that the structure would have stood, if unmolested, as long as a brick or stone edifice under the same conditions.

NEW BUILDING MATERIAL.

THE sole inventor of a process of crystallizing a product of stone, gravel, clay and cement, visited Toronto, Toronto Junction and Mimico last week, and procured samples of shale rock, sand and other materials, with which he returned to Buffalo, where the company of which he is managing director is putting up a plant. They propose to establish a Canadian plant, where all the necessary machinery, moulds, chemicals, tints, etc., may be manufactured and shipped to local plants to be erected throughout Canada. Both the buildings of the parent plant and the local factory will be constructed of their own material. The United States company erect a number of dwelling houses of different design and construction in the neighborhood of their plants, and these are sold to their employes on easy terms. The material possesses the advantages of being cheap, durable and handsome, and its manufacture in Canada should tend to lower the cost of workingmen's homes.

MACHINE BRICKLAYER.

P. H. LOUD, of Williston, S.C., has invented a brick-laying machine that will revolutionize the art of building, in addition to cheapening the cost of construction and the time necessary for the erection of brick structures.

It is claimed by those who have seen the machine that it will lay brick with all the skill of the most accomplished bricklayer, with perfect accuracy and with a rapidity that discounts the human hands. The report is to the effect that with two or three men operating the machine, supplying it with bricks and mortar, it will do the work of a dozen bricklayers in the course of a day, carrying up a wall as if by magic.

It is further claimed that the machine can be easily and quickly regulated so as to skip wherever it is desired to leave doors and windows, doing this work with seeming human intelligence. It is also said that the machine is not complicated, will not easily get out of order, and is in every way a practical and useful invention, sure to come into general use by contractors.

CONCRETE WAREHOUSE.

The brick and reinforced concrete warehouse recently built in Toronto, for Brown Bros., cost practically the same figure as for slow-burning mill construction. The building is 192 feet by 42 feet in plan, with storeys 10 feet, 15 feet, 14 feet 6 inches, 13 feet 6 inches, and 13 feet 6 inches high from basement up. The floors are designed to carry 300 pounds per square foot, and the columns are on 16-foot by 12-foot centres. The columns are reinforced by steel rods at the corners, with a wrapping of expanded metal like the hoops of other systems of construction. The columns are connected by concrete girders reinforced with six rods near their bottom surface, some of these rods being bent upwards at the ends. Instead of stirrups or loops, the girders have sheets of expanded metal at their ends. The floor-beams are of similar construction, but smaller.

Personal Mention

Mr. J. J. Main, who was chosen 2nd vice-president of the American Boiler Manufacturers' Association of the United States and Canada at the 17th annual convention held recently in Toronto,


John J. Main.

has had very wide experience in the boiler-making trades in Canada and the United States, having been connected with it since he was 13 years of age. He has witnessed and contributed largely to the development of the boiler making industry in Canada and also in the States. He was the one to make the first steel boiler in Canada; the first machine built for flanging boilers was operated by him; and he it was who built the first large Scotch marine boiler in Canada.

Mr. Main served his apprenticeship in the boiler shops of the old Northern Railway Company. Soon after completing his apprenticeship he worked for 2 years with Dickey, Neil & Co., Toronto. He then spent some time in the States in several cities, and gained considerable experience. In 1874 he returned to Toronto and was with Irwin & Marshall; in 1876 he went to Erie City, Pa., where he was foreman of the Erie City Iron Works; in 1877 he returned to Canada and engaged as foreman with Inglis & Hunter, Guelph; in 1880 he left this firm, going again to Erie City, but joined them again when the firm had become John Inglis & Sons, Toronto, and remained with them until 1895. In that year he became the superintendent of the Polson Iron Works Co., Toronto, of which firm he is now general manager. In 1896 he purchased the right to manufacture in Canada the Heine patent safety water tube boiler, and he is now president and manager of the Canadian Heine Safety Boiler Co., Toronto.

Mr. Main's enterprise is not confined to the boiler making industry. He is connected with many other industrial and financial enterprises, and instills into them some of the broadmindedness which has been one of his chief characteristics throughout his career as a boilermaker.

* * *

Mr. C. L. Wilkinson, of Marshall Sons & Co., Limited, engineers, Gainsborough, England, is on a visit to Canada. While on pleasure bent he will not altogether overlook the business interests of his firm, and will no doubt return to England with some plans outlined for the extension of trade with Canada. Before returning he will go as far west as Manitoba.

* * *

After a long and painful illness Mr. William Jessop, chairman of William Jessop & Sons, Limited, steel manufacturers, Sheffield, died on July 4, at the age of forty-eight. The deceased was the head of one of the most famous families in the whole metal world, and there are records of Jessops making steel in Sheffield as far back as 1774. Although chairman of one of the world's great steel industries, William Jessop never participated very actively in business life, and avoided public positions.

* * *

Mr. M. P. Shea, for the past two years Eastern Ontario representative for the Canadian Fairbanks Co., Limited, has now charge of the advertising and publishing departments, and will be succeeded by Mr. E. J. Holland, who is well known among the trade, having traveled in Eastern Ontario and on the Soo line for some time past.

* * *

On the occasion of his severing his connection with the Canadian General Electric Co., Limited, Mr. Frank L. Bradburn, for a number of years draughtsman with the company, was presented with a handsome meerschaum pipe and an address by his fellow employes.

Mr. C. H. Howard, who has been the representative of the Henderson Roller Bearing Co. for some time past, has accepted the Canadian agency for the Cleveland Automatic Machine Co., of Cleveland, Ohio, and Potter & Johnston, of Pawtucket, R.I. Mr. Howard has a practical knowledge of machinery, having been connected with the Canada Cycle & Motor Co. as foreman of the tool department for over seven years. Mr. Howard will spend a month in Potter & Johnston's shops, and about the same time in those of the Cleveland Automatic Machine Co., after which his address will be Dundas, Ont.

* * *

Mr. K. B. Thornton, electrical engineer, who has been connected with the Montreal Light, Heat & Power Co. for the past thirteen years, has resigned, to accept a position with the J. G. White Co., of New York, with which the Canada White Co. is allied.

Mr. Thornton, who is one of the best known electrical men in Montreal, and president of the Canadian Electrical Association, graduated from the Central Technical College, South Kensington, London, England, thirteen years ago, and came thence to Montreal. He became identified with the manufacturing department of the Royal Electrical Co., which developed into the Montreal Light, Heat & Power Co., where, for nine years, he has been connected with the operating end of the business.

In his new position, Mr. Thornton will be associated with the second vice-president of the J. G. White Co., Mr. P. G.


K. B. Thornton.

Gossler, who was for many years general superintendent and chief engineer of the Montreal Light Heat & Power Co. Mr. Thornton carries with him the best wishes of his many Montreal friends.

CANADIAN

MACHINERY

AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

The MacLean Publishing Co. Limited

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Managing Director : D. O. McKINNON, Montreal
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SPECIALIZING IN MACHINE TOOLS.

A COMMON American criticism of the Canadian machine tool industry is that the manufacturers do not specialize as they should. Recently an American tool builder was shown through a large Canadian plant where both iron and wood-working machinery is manufactured. He was somewhat surprised at the extent of the works and expressed his approval of the shop management.

"But," he said, "you Canadian manufacturers should specialize. Specialization has been the making of many of the large machine-tool builders on the other side," and he went on to point out the many advantages of specializing in one line of tools.

The advantages of specialization are not speculative but realities, and Canadian manufacturers are aware of the fact. If one line of tools was being built only, the management could devote their entire energies to promoting and keeping up-to-date that one line. The shop arrangement could be specific instead of general. The work required of each tool being more standard, specially designed tools with maximum output could be installed. The outlay for patterns would be less, and there are many other advantages. It is not ignorance of these advantages that has kept the Canadian machine-tool builder from specializing. It is the limited market. In the past there has not been room for a large firm to specialize. A market could not be found for the output of a large specializing plant. A manufacturer will naturally adopt the line of least resistance, and up to the present time adding different lines has been the field for expansion rather than the developing of one line exclusively.

However, Canada is developing very quickly, and the market for machine tools is broadening wonderfully. If Canada's industries continue to expand as they are doing at the present time, it will not be many years before the line of least resistance for the machine-tool builder will be specialization. Then will Canadian builders specialize. At present they have too much regard for dividends to spend time hacking down a mountain when they can make quicker headway by going around it. Time will diminish the size of the mountain, and there will come a time when dividends will demand that the remaining part of the mountain be leveled instead of following the path around it.

Meanwhile Canadian builders should watch the trend of affairs closely, in order that specialization may be taken advantage of as soon as it is practicable.

ECONOMY IN THE BOILER ROOM.

A LARGE item in the expense account of a manufacturing plant is the coal bill. Consequently manufacturers are careful to choose that coal which will give the most economical and otherwise satisfactory results. With many the fuel problem ends there, needless to say before it should. It has yet to be stoked, and there is more need for careful supervision over the stoking than over the buying. Whether done automatically or by hand, more than the ordinary laborer's intelligence is required in stoking. This is not fully realized by many manufacturers. It probably seems to them that stoking is merely shoveling coal, and they put a value upon it accordingly. In very many cases incompetent stoking is the result.

The engineer is supposed to supervise the boiler room, but he cannot watch the coal all the time, and many a pound of coal can be sent up the chimney uselessly by incompetent stoking in spite of the strictest supervision by a competent engineer. The trouble is that too little stress is placed upon the importance of good stoking, and consequently too small a wage is paid to induce a very intelligent man to stay at it for any length of time even if he finds himself placed in the position.

THIS MONTH'S COVER.

ONE of the installations recently made in the power house of the Ontario Power Co., Niagara Falls, furnishes the illustration on the front cover of this issue of Canadian Machinery. It represents one of three similar turbine sets now in place to be followed by seventeen others in the near future. They are the largest capacity horizontal type turbines ever built, and stand 13 feet in height above the floor, with a bed plate measuring 21 by 29 feet, and have a rating of 11,390 h.p., 700 cubic feet per second; 187½ revolutions, when operated under a head of 175 feet.

The turbines are of inward flow, double Francis type, having two runners of 78 in. diameter, each capable of developing 5,700 h.p. The water is controlled at turbine by swivel gates, which also act as guides. Lombard governors will be used. Relief valves are provided at the end of each penstock, discharging directly into the tail race. These enormous turbines are supplied by penstocks 9 ft in diameter, which enter the power house below the floor level. Where each penstock enters the building, a heavy thrust flange is imbedded in the enormous mass of concrete which forms the foundation of the entire plant. The thrust of the water column equals 650,000 lbs. for each turbine. The turbines

are set above, to one side of, and with shafts parallel to the penstocks, so that the supply pipes turn an angle of 90 degrees on the horizontal, and 45 degrees upward. The supply pipe ends in a spiral housing of heavily reinforced plates. The 175 ft. of head is made up of 155 ft. above the centre of the shaft, and 20 ft. below. Since the water level of the river varies greatly on account of the narrowness of the gorge, the tail race is separated from the river by a weir, with a crest 7 ft. above normal river level. Both draft tube and tail race below the floor level are entirely of concrete.

BENEFITING CANADA.

MANUFACTURERS in this country are not worrying over the present boycott of United States goods entering China. The situation is the outcome of a discrimination against Chinese labor as well as a lack of discrimination when their travelers, merchants and scholars attempted to enter the republic. This result had never been anticipated, but is a natural retaliation that is causing the Americans considerable concern at the present time.

Already inquiries have been received from China regarding Canadian manufactured products, and before the trouble is adjusted many of our enterprising manufacturers and jobbers will have secured an opening for future trade with the Celestial Empire. Our strenuous neighbors will some day waken to the fact that a generous policy in dealing with other countries is, after all, the most profitable.

MILLIONS FOR MATERIAL.

WHERE all the material to be used in the construction of the Grand Trunk Pacific is coming from is not yet known, but it has already been estimated what will be required to supply some of the necessary articles for the four thousand five hundred miles of track which the completion of the road will add to Canada's present twenty thousand railroad mileage. It has been figured that it will require 10,500,000 ties, nearly 500,000 tons of rails, 42,000,000 spikes, 5,000,000 bolts, 2,500,000 angle bars and fish plates, guards and tie plates also in the millions. It is estimated 500 locomotives, 30,000 freight cars, and 500 passenger cars will be required. Other items are bridge timber and steel, stations, telephones and telegraphs, water tanks, terminal facilities, fencing, etc., entailing an outlay of millions of dollars. These items are sufficient to warrant the commencement of many new industries at present not in active operation.

NORWAY WANTS GAS ENGINES.

IN his report Mr. C. E. Sontum, commercial agent at Christiania, Norway, states that more and more the fishermen there are discarding their old sailing boats and getting motor-driven boats or equipping their present hulls with gas engines. This is being done to such an extent that the trade in these with Norway is becoming an important one. There are many gas engine manufacturers in Canada, and without much effort a profitable market might be opened up by them. Mr. Sontum would no doubt be glad to give all particulars necessary.

TO LOWER EXCHANGE RATES.

FOLLOWING the lead of the American Bankers' Association, the Canadian Bankers' Association will try to recover the money order business of Canada, which is now almost entirely done by different express companies and the Government Postoffice Department. This action will end the practice of banks of charging 15 cents on a cheque whether it was for $3 or $50, and any amount under $5 will, according to the new rates agreed on, be put through for a charge of 3 cents; from $5 to $10 for a charge of 6 cents; from $10 to $20 for 10 cents, and from $20 to $50 for 15 cents.

MACHINERY MANUFACTURERS BUSY.

FAITH in the immediate future, coupled with a large number of orders in all lines, is keeping the machine tool manufacturers in Canada busier than is usual at this time of the year. For some years past the tendency has been in this direction—more work, more men required, with necessarily an attendant increased output. Providing increased capacity and accommodation has been the inevitable result and new buildings and plans for future expansion have followed hand in hand.

There is a feeling of activity in metal working circles bordering on buoyancy throughout which progress marks its course. Every plant of large scope, as well as those less pretentious, is working at its fullest capacity, and the latest labor-saving and rapid-production machines and apparatus are being installed. Although production is increasing rapidly the demand fully warrants it, and such promises to be the case for some time to come.

A NARROW POLICY.

MANUFACTURERS west of Montreal are continually complaining about the policy of the Nova Scotia Government in exacting a royalty upon the coal mined in that Province, in consideration of the protection accorded them by the tariff. This royalty, added to the great cost of transportation, makes the price of Nova Scotia coal in Ontario quite prohibitive, and the result is that practically all the coal consumed in Ontario is imported from Pennsylvania and Ohio. On this coal a duty of 67 cents per ton is exacted, and it adds materially to the cost of production in Ontario manufactories.

Now this duty was, of course, imposed to benefit the mines of Nova Scotia, but the Ontario manufacturers claim that this result is not achieved in their case, as the Provincial royalty prevents the eastern coal from being marketable in Ontario.

For a solution of the problem, two courses are proposed. One is that the Nova Scotia Government should waive the royalty on coal shipped west of Montreal, which would enable it to compete successfully with the imported fuel. But this question has often been discussed, and the authorities in the eastern Province show no disposition to make such a concession. The other plan is to remove the duty from coal coming into Ontario; but this would give rise to complaints of unfair discrimination in favor of one Province.

The question is rapidly becoming an acute one, and the Ontario men are using all possible means to secure a more equitable adjustment of the difficulty.

AMERICANS EXPLOITING CANADA.

COBALT'S development is another example of how our enterprising southern neighbors step in and capture the cream of the new discoveries of Canada's rich resources before Canadians realize their value, and move in time to secure the skim milk. In the Kootenays, the Yukon, the Alberta oil fields, at Sudbury and the "Soo," at Niagara, in our lumber industry, and in the power plants in Quebec and New Brunswick, the Yankees have been in the van in exploiting Canada's wealth.

At Cobalt it is the same story over again, visitors to this latest nine days wonder stating that already American companies have secured a very large share of the richest ground, the Nipissing Mining Co., said to be controlled by John D. Rockefeller, owning 1,600 acres. The Americans have been doing all the smelting at New Jersey owing to no plants being available in Ontario, but when talk arose of establishing a smelter at Toronto, the Americans controlling the copper industry of Algoma, moved swiftly and arranged to build a smelter at Copper Cliff to handle the rich Cobalt ores.

Every credit must be given our American cousins for their enterprise, but we desire to draw the attention of Canadians to the necessity of having boundless faith in the future development of Canada's riches, and the advisability of retaining control of this development by our own citizens. We cannot expect the Government to erect a high fence to exclude American enterprise, so the only way control can be retained is by developing an enterprising individuality in our own people.

CANADIAN IRON BOUNTIES.

IT appears that the iron industry of Nova Scotia is depressed because of the increasing use of foreign ore in this country under the present tariff and system of bounties. The Halifax Chronicle sets forth the grievance of mine owners, that the fiscal system of the Dominion places them at a serious disadvantage. Iron ores are on the free list, and foreign ores are driving native ores out of use.

Prior to 1896 iron bounties were granted in a way to support and develop the iron mining industry of Canada. Two dollars a ton was paid on all pig iron made in Canada from native ore; two dollars per ton on all iron puddled bars made in Canada from Canadian pig iron manufactured from Canadian ore, and two dollars per ton on all steel billets made in Canada from pig iron made from Canadian ore, and such other ingredients as necessary and usual; no payment to be made with respect to foreign ores used in the products mentioned. The bounties were exclusively limited to Canadian products.

The present Government, however, has increased the bounty tax, while cutting down the bounty benefit to the iron mines. Three dollars is now paid in bounty on steel ingots made with fifty per cent. of pig iron made in Canada. On pig iron a bounty of three dollars is paid on the proportion produced from Canadian ore and two dollars per ton on the proportion produced from foreign ore.

The bounty on foreign ore is not as large as on the home article, but the difference is so slight that no appreciable advantage is afforded the Nova Scotia mines. Another great change introduced in the legislation of 1897 was that it placed no limitation as to Canadian ores in the bounties payable on puddled bars and steel billets. There may not be a pound of Nova Scotia ore or other Canadian ore entering into the iron used in those bars or billets, yet every ton of them is entitled to a $3 bounty. The result of the policy has been to reduce the production of iron ore in Nova Scotia from 58,810 tons in 1896 to 16,172 tons in 1902.

Government statistics throw another light on the manner in which the iron mining industry of Nova Scotia has been sacrificed to the foreigner. In 1903 the Dominion Iron and Steel Co. used no Canadian ore, but 205,510 tons of foreign, on which bounties of $136,875 were paid. The Nova Scotia Steel and Iron Co. used 4,653 tons of Canadian ores, and 15,395 of foreign ores, on which $40,276 was paid in bounties. Of the $412,000 of bounties on pig iron alone, less than one thirtieth part was paid in respect of iron from Nova Scotia ores; while as to the bounties paid on puddled bars and steel ingots, the new laws give Nova Scotia ores no advantage whatever.

DO WE WANT THE METRIC SYSTEM?

AS matters now stand, despite the bitter opposition on the part of those opposed to it, the adoption of the metric system in the United Kingdom seems assured. For some years a strenuous warfare has been carried on between the Decimal Association, who have been making every effort to educate people as to the merits of the decimal system and to make it compulsory by law, and the British Association of Weights and Measures, whose aim and object is the preservation of the present standards. Whole volumes were written by both parties with arguments for and against. The Decimal Association and its supporters, with Lord Kelvin as one of its most active workers, has got well in the lead. A bill to render the metric system compulsory in Great Britain has passed the House of Lords and is now before the Commons. A circular issued by the Decimal Association states that more than 330 members are pledged to its support and every effort will be made to carry the bill through.

While we believe that the metric system possesses advantages above the present standards sufficient to warrant its general acceptance, and that it is merely a matter of a few years before its use will become almost universal, the change will involve an enormous expenditure of time and money.

Such a change would affect the manufacturers of machinery and machine tools more than any other class, necessitating the re-designing of all tools and a large amount of the apparatus at present employed. We would like to hear an expression of opinion from some of our Canadian manufacturers as to whether or not you would like to see the metric system adopted in Canada, and if so, how long before you would be in a position to put it into operation.

INCREASED DUTY.

Mexico's new tariff specifies an increased duty on machines of all kinds for industry, agriculture, mining, and the arts not specified, and their loose parts or repair parts, from $1.50 per hundred kilos to $1.65.

ENGINEERING NEWS

AND BUSINESS NOTES

SOCIETY OFFICERS.

Canadian Society of Civil Engineers.

Officers for 1905: President, Ernest Marceau, Montreal; treasurer, H. Irwin; secretary, C. H. McLeod Rooms: 877 Dorchester St., Montreal.

Engineers' Club of Toronto.

President, R. F. Tate; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms: King St. W., Toronto.

Canadian Mining Institute.

President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Land, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Toronto Branch A. I. E. E.

Chairman, H. A. Moore; vice-chairman, R. G. Black; secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Association of Stationary Engineers.

President, Chas. Moseley, Toronto; secretary, A. M. Wickens, Toronto.

Ontario Association of Stationary Engineers.

President, F. W. Donaldson; registrar, J. G. Bain, 113 Yorkville avenue, Toronto.

Engineers' Society S. P. S.

President, J. P. Charlebois; recording secretary, E. C. Ash; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriss.

Boiler Manufacturers Meet.

ABOUT one hundred and fifty representative boiler manufacturers of Canada and the United States were in attendance at the 17th annual convention of the American Boiler Manufacturers' Association in Toronto during the last week of July, the ladies accompanying the delegates being royally entertained by a committee of Toronto ladies, while the delegates transacted the business of the convention. Millions of dollars' worth of plants were represented by those present and the technical subjects discussed were of the utmost importance to the trade.

One of the association's objects is to secure higher standards of material and workmanship, and thus insure greater safety to the public and to secure the passage of laws making the use of inferior materials a criminal offence.

The associated trades supplying materials to the boiler-making plants also send representatives to the convention and supply a large fund to defray the pleasure features of the gathering. John J. Main, of the Canadian Heine Safety Boiler Co., Toronto, acted as chairman of the local committee having charge of the arrangements, other members being Joseph Wright, W. P. Bull, Wm. J. Guy, Wm. Inglis and T. H. Hamilton.

One really important result of the convention was the getting together of the American steel manufacturers and the boiler manufacturers, who for some years have been at variance over the quality of steel plates. The A.B.M.A. uniform boiler specifications call for the proportion of sulphur in steel plates exposed to the direct heat of fire or the gases of the combustion not over .025 per cent., but the manufacturers objected to being bound to furnish this grade and thought the boilermen should be satisfied with .035. The boilermakers were willing to recede to .030, but the steel manufacturers have still held out to make it .035. The outcome will likely be a conference between the bodies interested.

Gen. E. D. Meier presented the report of the committee on uniform boiler inspections, reviewing several years' hard work at Washington, endeavoring to get a commission appointed to straighten out the tangle of inspection laws. The Slocum disaster has been a weapon in the committee's hands. The Federal laws apply to marine boilers, but the same legislation is reflected in the acts of States and municipalities with regard to land boilers.

John J. Main, of Toronto, told the convention that Canadian manufacturers were affected by the United States laws, and that conditions in Canada itself with regard to boiler inspection might be improved.

Officers were elected as follows: R. Munroe, jr., Pittsburg, Pa., president; J. D. Farasey, Cleveland, O., secretary; Joseph Wangler, St. Louis, Mo., treasurer; M. F. Cole, Newman, Ga., first vice-president; John J. Main, Toronto, second vice-president; John Rourke, of Savannah, third; J. Don Smith, of Charleston, fourth, and G. H. Kittoe, of Aurora, Ill., fifth. The association meets next year in Pittsburg.

Civil Engineers' Excursion.

A trip from Montreal to Toronto and Niagara has been proposed by the Canadian Society of Civil Engineers, to leave the former place on the evening of September 12. It is intended to spend a day in Toronto visiting the various engineering works, and on the following morning to leave for Niagara Falls.

Engineers' Club Outing.

On Friday, July 28, the Engineers' Club, of Toronto, had their annual outing to Hamilton, going to Burlington Beach by the Turbinia. The party was met by special car and conveyed to the Hamilton Steel and Iron Works, the International Harvester Co.'s works, and the substation of the Hamilton Cataract Power Co. After lunch at the Royal Hotel, other visits were made before the party sat down to dinner, returning at 8.45, after an enjoyable day.

Society of Chemical Industry.

The Society of Chemical Industry will hold their next convention in Toronto this Fall, when a large number of interesting and important papers will be read. The officers of the society are: President, Sir William Ramsay; chairman, F. J. Smale, Ph.D.; hon. local secretary and treasurer, Alfred Benton, Toronto.

Toronto Branch C. M. A.

AN increase of 102 in membership for the year was reported at the annual meeting of the Toronto branch of the Canadian Manufacturers' Association, held on Thursday last. The membership now comprises 497 manufacturers, and the influence of the body is growing in proportion to its increasing size.

Chairman Donald's report was a very painstaking and important document, dealing with many questions of first importance to the city of Toronto. Under the heads: "The Trunk Sewer," "Straightening of the Don," "The Radial Railway," "Front Street Expropriation," "The City Beautiful," Mr. Donald touched upon civic affairs and arraigned the city authorities on several charges of laxity and dilatoriness. The delay in providing better sewage disposal and the delay in straightening out the Don were subjects of comment.

Regarding the parliamentary inquiry with respect to the telephone service of Canada, the branch expressed itself as follows: "That municipalities should have an absolute right to control the placing of wires within the city. That the trunk telephone lines should be owned by the Government. That all citizens resident in a municipality in which any company has established a telephone system, and who are prepared to pay for services, should be provided with a telephone at whatever rate is established, and the same rate shall apply to all. That all telephone companies should have equal rights in all railway stations.

The branch had passed resolutions approving of the immediate construction of a trunk sewer in Toronto, requesting the Government to put express companies under the jurisdiction of the Railway Commission, and approving of the $300,000 by-law for improvements to the Toronto Exhibition.

The election of officers resulted as follows: Chairman, W. B. Tindall; vice-chairman, John Firstbrook; committee, H. W. Beatty, S. B. Brush, C. N. Candee, J. W. Cowan, P. W. Ellis, Ed. J. Freyseng, S. R. Hart, A. Jephcott, J. S. King, J. S. McKinnon, R. E. Menzie, W. H. D. Miller, John Northway, A. S. Rogers, Frank A. Rolph.

Practical Questions and Answers

Cast Iron Constituents.

Ques. What are the constituents of cast iron and what effect has each on its strength and texture? Also, what is the differcnee between white and grey cast iron?

Ans. The chief constituents of cast iron are carbon, silicon, manganese, phosphorus and sulphur, but there are often traces of one or more of the following: Copper, arsenic, chromium, nickel and others. Of these, carbon and silicon are always present, while sulphur, phosphorus and manganese are nearly always present. The carbon has the greatest effect, the per cent. of that element deciding whether the iron shall be cast iron, wrought iron or steel. Silicon and sulphur are the next two elements having the greatest effect. The addition of carbon to iron up to a certain per cent. hardens and strengthens the iron; the presence of much silicon prevents the carbon from uniting chemically with the iron, and is the cause of grey cast iron; sulphur weakens the iron very considerably if present over a very small per cent.; if there is less than 5 per cent. of manganese it does not affect the iron; phosphorus makes the metal more brittle, but also more fluid in molten form; up to a certain per cent. copper and most of the minor constituents will strengthen the iron. The limiting composition of good cast iron for the chief constituents is as follows:

Carbon	2.75 to 3.25 per cent.
Silicon	1.90 to 2.40 per cent.
Manganese	0.40 to 0.80 per cent.
Phosphorus ...	0.25 to 0.60 per cent.
Sulphur	0.02 to 0.05 per cent.

The difference between white and grey cast iron is that in the white iron all the carbon is chemically combined with the iron as Fe_3C_3, while in the grey iron the carbon is in the form of graphite mechanically mixed with the iron. The iron has a greater chemical attraction for silicon than for carbon, and thus if there is much silicon present the iron as it cools will unite with the silicon and the carbon remains in the form of graphite. Sometimes there is not sufficient silicon to crowd out all the carbon and the result is a mottled cast iron. The white cast iron is harder than the grey but is also more brittle. Thus grey iron is suitable for castings and white iron for conversion into wrought iron.

Wear of File Teeth.

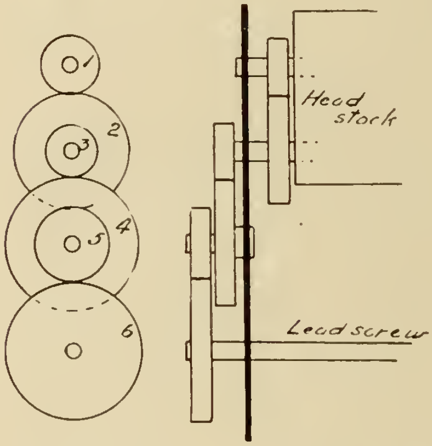
Ques. In filing operations the file will wear away quicker on thin or narrow work than on a wide surface. What is the reason of it?

Ans. In filing narrow surfaces the machinist generally exerts the same pressure on the file as with a broad or flat surface. There is consequently a greater pressure on fewer teeth, subjecting them to greater strain, hence they break off and wear away more rapidly.

Figuring Gear Ratio.

Ques. What is a convenient and simple method of computing the arrangement of gears to cut a thread of certain pitch on any given lathe?

Ans. Let "m" equal the number of threads per inch on the screw, "n" equal the number of threads per inch required to be cut on the work, and let "v" equal the ratio of the lathe to the former, i.e., n/m. Now the velocity rates of gears vary as the diameters, and if the pitch of the gears is the same, which it always is in the same set, the velocity ratio varies with the number of teeth in the gears. Now the ratio of the first to the last gears in a compounded gear train is equal to the ratio of the product of the numbers of teeth in the driven gears to the product of the numbers of teeth in the drivers. That is in the accompanying figure:



$$r = \frac{n}{m} = \frac{t_2 \times t_4 \times t_6}{t_1 \times t_3 \times t_5}$$

where t_1, t_2, etc., denote the number of teeth in 1st, 2nd, etc., wheels.

Now, let us suppose that it is required to cut 100 threads per in. on a piece of work in a certain lathe in which the screw had 6 threads per inch. Then

$$v = \frac{n}{m} = \frac{100}{6}, \text{but}$$

$$r = \frac{t_2}{t_1} \times \frac{t_4}{t_3} \times \frac{t_6}{t_5}, \text{ and}$$

$$\therefore \frac{t_2}{t_1} \times \frac{t_4}{t_3} \times \frac{t_6}{t_5} = \frac{100}{6}$$

Now, suppose that $\frac{t_2}{t_1} = \frac{2}{1}$, as it does in certain lathes. Then substituting:

$$2 \times \frac{t_4}{t_3} \times \frac{t_6}{t_5} = \frac{100}{6}, \text{ or}$$

$$\frac{t_4}{t_3} \times \frac{t_6}{t_5} = \frac{50}{6} = \frac{100}{12} = \frac{10}{4} \times \frac{10}{3}$$

Supposing the set of gears used were arranged in multiples of 7; then:

$$\frac{t_4}{t_3} \times \frac{t_6}{t_5} = \frac{10}{4} \times \frac{10}{3} = \frac{70}{28} \times \frac{70}{21} \text{ or}$$

$$= \frac{70}{28} \times \frac{140}{42}$$

Thus t_4 is 70, t_3 is 28, t_6 either 70 or 140, and t_5 either 21 or 42.

In the same way any other required thread can be cut with a lead screw of any other pitch. The ratio $t_4 : t_1$ may also be different, but the same method may be followed throughout. If the gearing is simple instead of compound there will be no necessity for factoring. Of course an idler in the gear arrangement need not be taken account of except as it affects the direction of rotation.

Boiler Horse Power.

Ques. What is meant by the horse-power of a boiler?

Ans. The horse-power of a boiler is of a necessity a measure of its capacity to generate steam, and it has been the custom of boiler-makers to measure this in terms of the heating surface. However, this was very unsatisfactory since the heating surface on one boiler would often generate more steam than the same amount of heating surface on some other boiler. For this reason the American Society of Mechanical Engineers have adopted as a standard horse-power an evaporation of 30 lbs. of water per hour from a feed water temperature of 100 degrees Fahr. into steam at 70 pounds gauge pressure.

Standard Key Dimensions.

Ques. Is there any standard taper and dimensions for keys, and if so what are they?

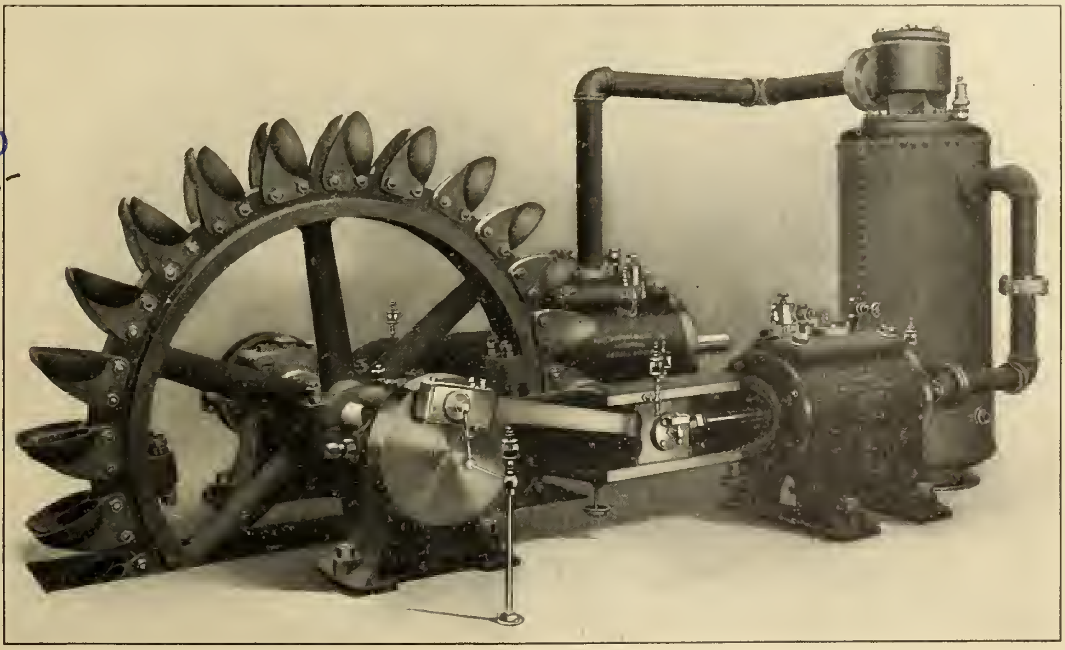
Ans. There is no standard taper or dimensions, and those used in general practice vary to a very considerable extent. An average taper is ⅛ inch per foot of length, and average dimensions are 5-16 of the diameter of the shaft for the breadth and ¼ for the thickness of sunk key and 3-16 for flat key. Probably the best practice is, however, 3-16 inch per foot for taper, ¼ the diameter of the shaft for width and 1-6 the diameter of shaft for depth.

Power and Transmission

Steam Gas Electricity Compressed Air Water

AN IDEAL FORM OF POWER.

ONE of the valuable applications of compressed air is shown by this cut. To obtain power for mining operations at Lardeau, B.C., the Elwood Tinworkers Gold Mining Co. decided to utilize a mountain stream nearby. For this purpose Allis-Chalmers-Bullock, Limited, built a compound duplex Ingersoll-Sergeant air compressor with piston inlet valves, to be driven by a Doble water wheel which will develop 90 h.p. under the 170 ft. head afforded by the stream. This combination of nature's forces makes an almost ideal form of power.

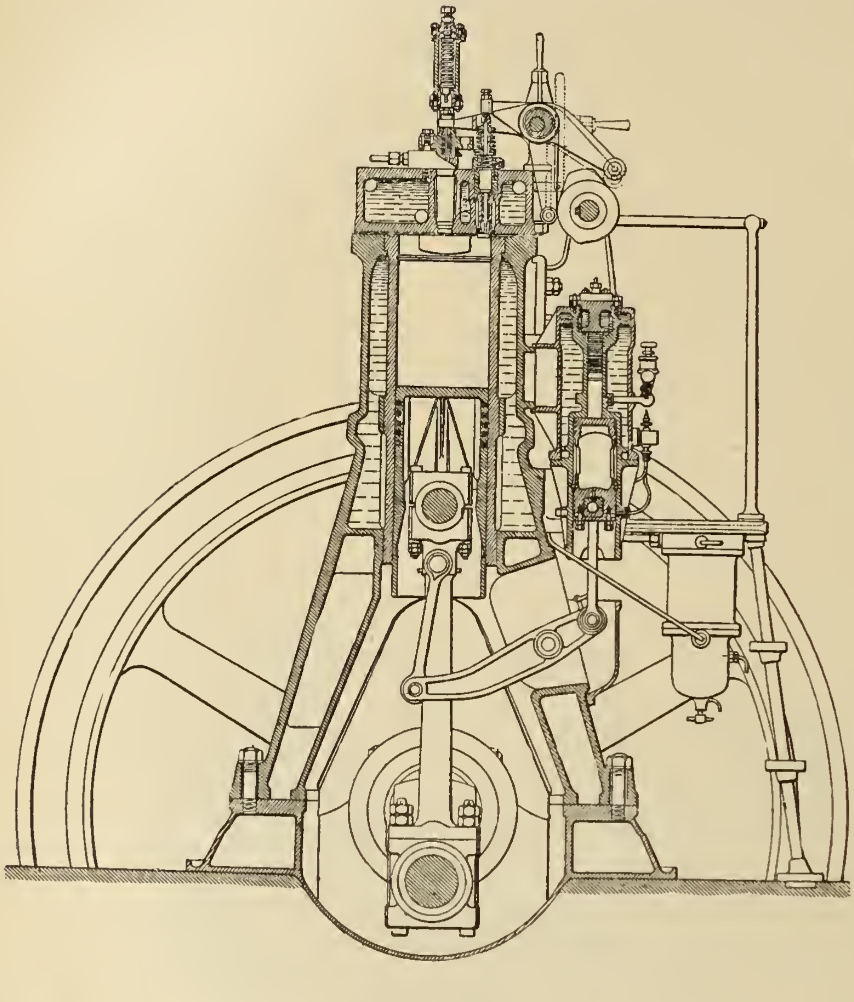


Ideal Form of Power.

DIESEL OIL ENGINE.

THE ENGINEER, of London, describes a British-built Diesel oil engine made by the Mirrlees-Watson Co., of Glasgow. The company met with many difficulties in its first engine, which was in some respects a failure; but after waiting a number of years material progress has been made, and it constructed another. In this case the size selected was 35 brake horse-power, single cylinder—the diameter of the cylinder being $11\frac{3}{4}$-in., stroke 18-in. This Diesel oil engine, which embodies the various improvements which had been made up to that time, was started in the early part of 1903, and was put through a series of brake tests and reliability trials, which it passed successfully, and it was decided to instal it as part of the works plant and treat it in every way as an ordinary engine. It was therefore arranged that the engine should drive a load of a very variable character, such as wood-working machinery, cranes, etc., this being the character of load which would try it most severely. One of the changes embodied in this engine was in connection with the air compressor. The first engine made gave trouble owing to the high temperature of the air in the air compressor; to overcome this the German company compressed the air in two stages in a very ingenious manner, advantage being taken of the fact that air only is compressed in the main cylinder during the compression stroke. It was arranged to draw from the main cylinder air compressed to about 150 lb. pressure. For this purpose the overflow valve was placed in the cylinder cover, and opened momentarily during the compression stroke, when the compression in the cylinder was about that named. The air passed out of the cylinder to a cooler, and from there was delivered to an air pump of small diameter. By this arrangement the main cylinder and the small pump formed a two-stage compressor, with an intercooler between the stages. This got over the trouble experienced with the compressor valves when using a single-stage compressor, as in the engine constructed in 1897, and it worked admirably when using clean oils, such as are readily obtainable in Germany. The company, however, was anxious that the engine should be entirely suitable for using crude fuel oil, such as Texas crude petroleum. After some months of regular working with crude oil, it was found that a brown deposit formed on the air-compressor valves. Experiments were, therefore, carried out to discover the cause of this deposit, and it was found that although the combustion was perfect, and the exhaust practically colorless and odorless, a fine brown dust, presumably the ash of the heavier constituents of the fuel oil, was deposited in the combustion chamber; a little of this became mingled with the air passed to the air compressor. The amount of this dust was extremely slight per stroke, but became, after a few months of working, appreciable and sufficient to affect the tightness of the compressor valves, unless these were cleaned regularly. To obviate this fre-

quent cleaning of valves—the only difficulty in the engine—an entirely independent two-stage air compressor fitted with efficient cooling arrangements was constructed. Air was supplied from this compressor, and it was found that by



Diesel Oil Engine.

this means the difficulty just described was overcome.

A POWERFUL LITTLE ENGINE.

The accompanying cut illustrates a 35 h.p. 4-cylinder, 4-cycle gasoline engine, as built by the Hamilton Motor Works, Limited, Hamilton. The engine is only 2 feet 6 inches long and 24 inches high, and runs at from 900 to 1,000 revolutions per minute. As far as possible the working parts are outside the crank case, so as to be readily accessible to the attendant. The port areas are extra large, the inlet being on one side and the exhaust on the other. The valves are of the mushroom pattern, operated by cams. The engine is fitted with jump spark ignition.

The launch in which this engine has been installed is 30 feet long, 5 feet beam, torpedo stern, and, although not built specially for speed, has proved very fast.

FIRE PROTECTION AND WATER SUPPLY.

An example of what is probably one of the most up-to-date installations of this kind in practice is to be seen in the new Henry R. Worthington Hydraulic Works at Harrison, N.J., a view of the air lift of which is shown.

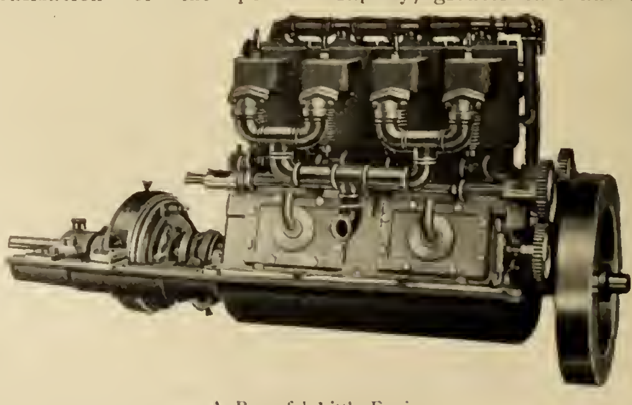
Water is raised by the air lift, which is peculiarly well adapted to scattered batteries of bored or drilled wells. It permits centralization of the power plant, as the air compressor may be located at any convenient point and the air piped to the wells. It also eliminates all valves, plungers and other moving parts from the well itself, thus doing away with the air arising in other devices from sand and gravel. The principle of the air lift is illustrated in Fig. 1. Compressed air is forced into the water through a nozzle inside and near the bottom of the flow pipe, forming a column of mixed water and air of low specific gravity within the latter which, under the pressure of the solid column of the water in the well outside, rises continuously. The submerged parts of the pumping outfit consist simply of the wrought iron casing flow and air pipes, a strainer, an elbow and pipe connections, all of which are practically indestructible even when working in gritty water. At the Worthington plant there are four of these wells averaging 400 ft. in depth scattered within a 200-ft. radius, and having 8-in. casings, $5\frac{5}{8}$-in. air and $4\frac{3}{4}$-in. flow pipes. One well discharges the mixture of air and water directly into the concrete basin or reservoir nearby. In the others the air and water discharge vertically from the flow pipe against an "umbrella," which allows the air to escape while diverting the water back into an open concrete basin from which it flows by gravity into the reservoir.

Air is supplied to the wells at a pressure of from 80 to 85 lb. by a Laidlaw-Dunn-Gordon compressor in the main power house, having a capacity of about 800 cu. ft. of compressed air per minute. Ninety lb. pressure is required to start the wells, but 60 lb. will maintain the flow. When it is desirable to pump an unusual quantity of water, or stop this compressor, a large Cincinnati-gear compressor by the same builders, which furnishes the aid for the foundry, machine shop and other departments, may be employed.

ELECTRIC TRAVELING HOIST.

Now that electric traveling hoists have passed the experimental stage and their use is extending so rapidly, greater care has been given in their design to the question of durability.

The new Niles electric traveling hoist



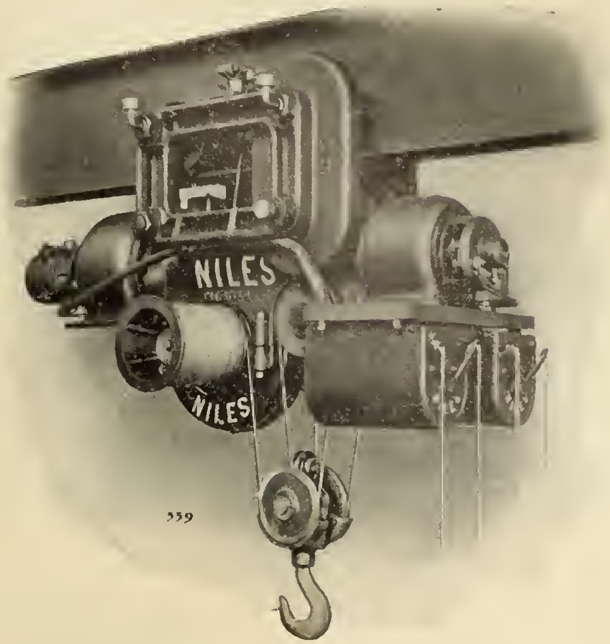
A Powerful Little Engine.

is designed for hard, continuous service, and fully comes up to this company's standard in quality of work and design of details. As may be seen in the illustration the hoist is of compact design, and is self-contained in one heavy cast iron frame to which the motors are attached end on. The power is transmitted directly from the armature shaft to the drum shaft through one train of worm and worm wheel gears. The traversing mechanism is also driven through one train of worm and worm wheel gears, similar to the hoisting mechanism, except that, when the trolley is arranged to run on a single I-beam, a double set of transmission gears are used. All the mechanism is enclosed in oil and dust-proof casings, and is absolutely noiseless in operation.

In addition to the braking effect obtained by the use of the worm and worm wheel, a powerful electric brake is attached to the hoist motor.

These hoists when mounted on a traveling bridge may be used as small-capacity cranes. When used as cranes, the hoists are arranged to run between the two I-beams or channels of the bridge, and the controllers for raising and lowering the hook and operating the traversing mechanism may be placed either on the hoist, on the bridge, and operated by cords from the floor, or in an operator's cage attached to the bridge.

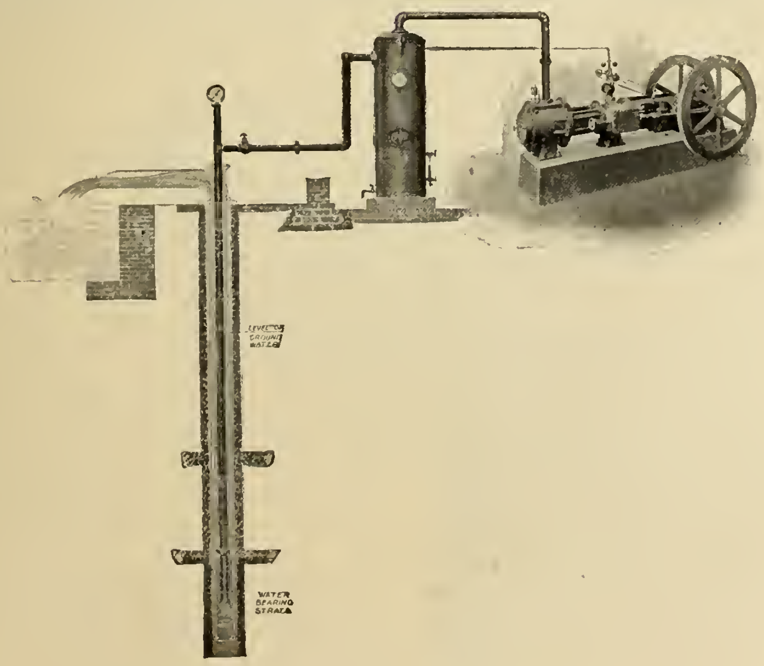
The Niles hoists are built in capacities of $\frac{3}{4}$ to 6 tons, and are usually arranged to run on an I-beam track. They will run on straight and curved tracks and are generally provided with a separate motor for traversing, but if desired, hand traverse may be furnished, or all the traversing mechanism may be omitted and the trolley moved along the track by pushing on the load. The increased service of the electric traverse, however, much more than compensates for the slight additional cost.



Electric Travelling Hoist.

MINE HAULAGE BY COMPRESSED AIR.

With the increasing use of compressed air in mine haulage is coming wider recognition of its merits. Second to no other power in simplicity and convenience of operation, it is particularly suitable for coal mines, where safety from fire is ever the first consideration.


Air Lift, Fire Protection System.

An air haulage system has lately been installed at the coal mines of the International Coal and Coke Co., Coleman, Alberta, Canada, and is in daily operation between the mine workings and the tipples. The system consists of the track and rolling equipment, power generating plant, air storage system and charging stations.

The track is 2,000 ft. long at present, provision having been made for extension as required. Starting at the working face of the coal, the track has a 12 per cent. up grade 150 feet long, which changes into a 1 per cent. down grade for 850 feet. Passing round a 60 degree curve it than has a $12\frac{1}{2}$ per cent. up grade for 700 feet, changing into a slightly down grade for 300 feet to the tipples, which are situated near the Canadian Pacific Railway tracks.

The loaded cars weigh 5,000 pounds each, the usual train consisting of twenty-five cars and weighing about 67 tons, exclusive of the locomotive. The locomotive is of the Rand single tank type, taking in air at a pressure of 900 pounds, and automatically reducing the pressure to 140 pounds at the cylinders. The cylinders are 6 inches diameter by 10 inches stroke. The locomotive carries sufficient air for the round trip of about one mile, taking usually ten minutes' time.

The generating plant consists of a four-stage air, duplex steam-driven Rand compressor, of standard design. It is fitted with their well-known direct connected water tube intercoolers, special provision having been made to take out the heat of compression in the high pressure cylinders. The compressor has a capacity of 600 cubic feet and delivers

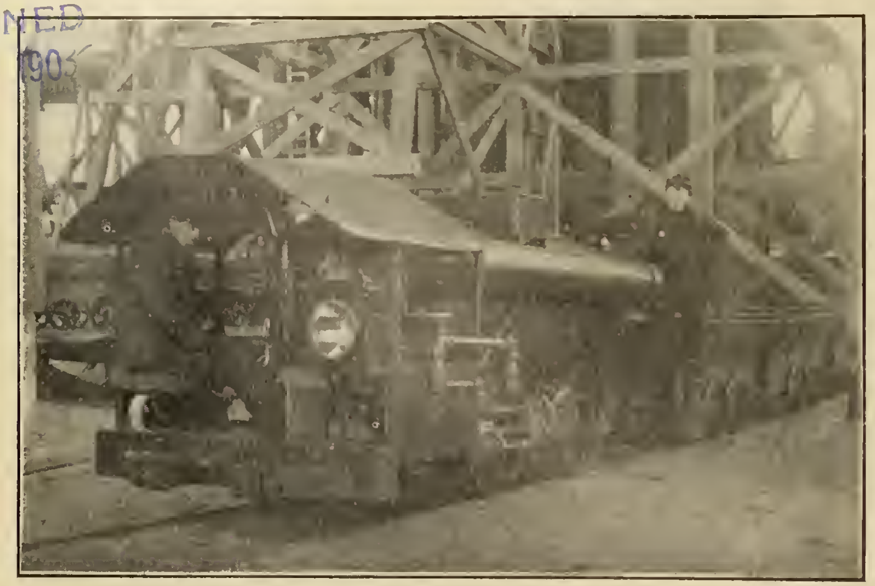
air to the storage system at 1,000 pounds terminal pressure.

View of Tipple for Compressed Air Mine Haulage.

The whole plant was designed and built by the Canadian Rand Drill Co. at their works in Sherbrooke, Quebec, Canada, and was successfully installed under the direction of one of their erecting engineers.

IS THE TURBINE BUSINESS GROWING?

THAT the steam turbine is rapidly increasing its foothold in the power field is evidenced by the remarkable increase in manufacture of the well-known Westinghouse-Parsons type. During the six months ending June 30, 1905, the Westinghouse Machine Co., exclusive builders of the Westinghouse-Parsons type, have contracted for no less than 82,000 kilowatts in turbo-



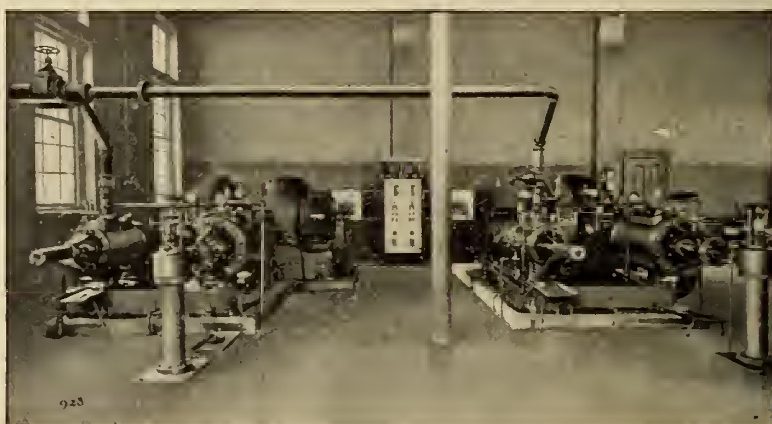
Compressed Air Locomotive.

generating machinery, averaging nearly 1,175 k.w. capacity per turbine unit. These machines range in size from 200 k.w. to 7,500 k.w. The latter will be the largest turbines in the world, and three units of this size are under contract for Greater New York railway and lighting power stations. In the distribution of these machines among the various industries, the electric railway has claimed the largest number of machines, averaging 1,496 k.w. in capacity; next in order, industrial plants, averaging 571 k.w. capacity, and light and power plants, averaging 1,529 k.w. capacity. In the order of total capacity, railway plants have required 38,900 k.w., lighting plants, 26,300, industrial, 12,000, miscellaneous, 4,800.

This list bears excellent witness to the increasing possibilities of the turbine, and presages a brilliant future. The equipments noted represent solely actual sales only and not including contemplated business or partially closed contracts.

MODERN COMPRESSOR PLANT.

THE air power plant at the terminal station of the Chicago and Northwestern Railway in Chicago is a fine example of the best modern practice



A Modern Compressor Plant.

in the application of electric power to the compression of air for the many purposes so characteristic of railway yard work.

The plant is located in a small brick building in the rear of the main terminal station, close to the river and adjacent to the extensive passenger yards of the company. This building comprises two rooms, in one of which are the steam boilers for the heating system of the station. In the other section is located the electrical and pneumatic apparatus.

Alternating current is taken from the city mains of the Chicago Edison Co. and passed through transformers reducing it to the working voltage. Part of it is used directly on low-voltage alternating circuits. The remainder is passed through rotary converters or motor generators and delivered as direct current for power purposes.

The air compressor plant is made up of two Ingersoll-Sergeant standard power-driven compressors, of the type designated by the makers as class "J.

C." They are duplex two-stage machines, with air cylinders, frames, and bearings, mounted on a solid cast iron bed plate which encloses the horizontal intercooler between the cylinders. Both high and low pressure cylinders are fitted with the standard Ingersoll-Sergeant piston inlet valve and regulation is secured by the marker's standard choking controller on the low-pressure intake. This device, acting to throttle the air intake passage, is controlled by receiver pressure and automatically regulates the volume of air compressed and, consequently, the amount of power consumed to the demand for air from the power system. The compressors run at constant speed, the controller simply varying the effective piston displacement with carrying load. The machines have a stroke of 12 inches, with air cylinders 12¼ and 18¼ inches in diameter. At their speed of 130 r.p.m. the free air capacity of each unit is 455 cubic feet per minute. The pressure used in this plant is 70 to 80 lbs. gauge.

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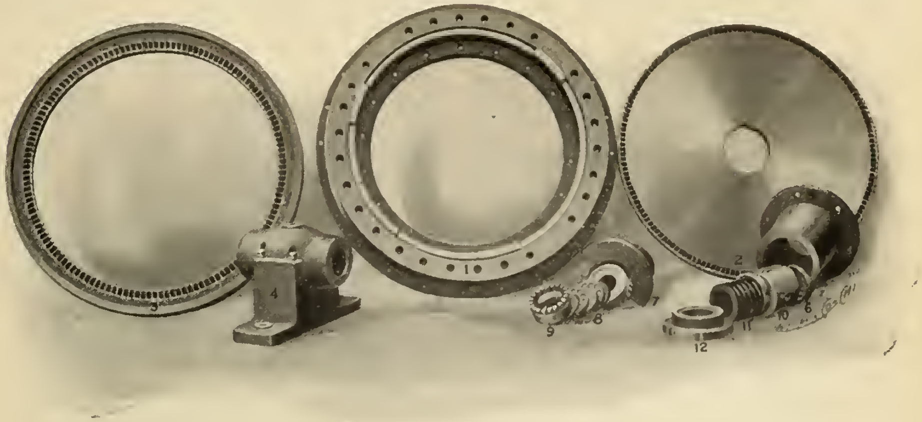
TURBINE ALTERNATOR SET.

TWO illustrations show views of the Warren turbine alternator and some of its parts, which are manufactured by the Warren Electric Mfg. Co., Sandusky, Ohio. The design of this turbine is based upon the best structural features known. Some of the special features are: That the steam is expanded almost entirely within the nozzles; the design and workmanship of the assembled discs of rotating vanes in their relation to the assembled stationary vane are such as to maintain through the whole number of vanes the ideal angularity of flow of steam; The shape of the nozzles through which the steam is expanded is such that the steam expands in an elliptical curve, the effect of which is freedom from eddies or conflicting steam currents. Another feature of these turbines is that they are governed without throttling, this being accomplished by an effective multiple valve arrangement. These sets are built in sizes from 100 to 3,000 k.w., and in speeds of 3,600 to 600 r.p.m. without any gearing in the main drive.



Parts of Warren Turbine.

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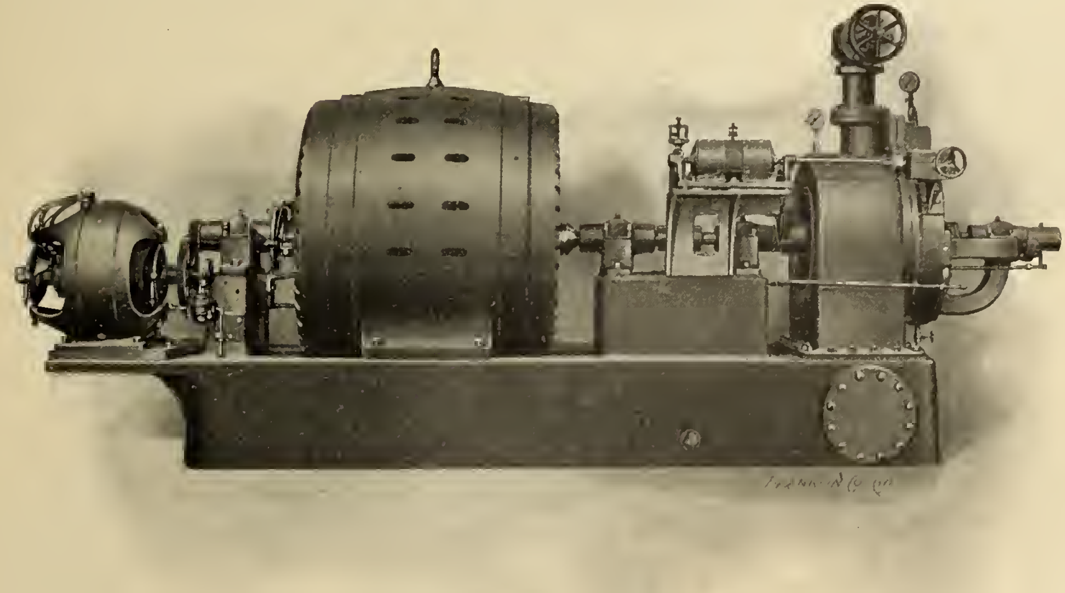
A UNIQUE WATER POWER.

Although many people are aware of the presence of a wonderful lake in Prince Edward County, Ont., it may not be generally known that it daily adds its quota towards the development of industry in this country. The lake is remarkable for the fact that it is situated on the height of land in Prince Edward County at a distance not more than 100 yards from the Bay of Quinte and 190 feet above the level of the bay. There is no overland inlet to the lake as the land slopes downward gradually at the back and steeply towards the bay at the front, and there is no outlet. The body of water is nearly a mile long and about three-quarters of a mile wide, being somewhat elliptical in shape. Owing to the clearness of the water the bottom of the lake can be seen very plainly at a distance of 100 yards from shore. When a decided change comes and suddenly there is a depth of several hundred feet.

For many years the water power of this lake has been used to drive the Glenora mills and the turbine waterwheel plant, both of which are owned by J. C. Wilson & Co., of which Mr. F. S. Wilson is the president and manager. A 22-inch pipe is let down the side of the hill from the lake to the works, giving an available head of 175 feet. Here a 4¼-inch "Little Giant" turbine waterwheel, running at a speed of 3,200 revolutions per minute, generates sufficient power to run the entire machinery. To see this small water-wheel and to know that it is generating a great many horse-power, although weighing but a few pounds, is of more than passing interest, to say the least.



209 K.W. Warren Turbine Alternator.

ABOUT CATALOGUES

Any Catalogue spoken of on this page will be sent upon request. Kindly mention Canadian Machinery.

Prize List. The 1905 prize list of the Canadian National Exhibition, Toronto, has been published. Rules regarding the machinery hall are to be found on page 16. There are 96 pages, 8 x 4 inches.

H. W. Petrie's Stock List. The monthly stock list of new and second hand iron and woodworking machinery, besides engines, boilers and steam appliances, is to hand. It contains 32 pages, 3 1-2 x 6 inches.

"Axial Valve" Hammers. The Ingersoll-Sergeant Drill Co., 26 Cortlandt street, New York, have issued circular form No. 6, illustrating and describing their Haeseler "Axial Valve" pneumatic hammers; nineteen pages, 6 x 9 inches.

Crandall Packings. A new catalogue and price list of the Crandall Packing Co., Palmyra, N.Y., has been issued. In this are described and listed steam, ammonia and hydraulic packings; contains 70 pages, 8 x 5 inches.

Northern Cranes. Catalogue No. 20, of the Northern Engineering Works, Detroit, Mich., illustrates and describes in detail the Northern standard electric cranes, also electric hoists of many kinds; contains 100 pages, 6 x 9 inches.

Heavy Duty Corliss Engines. Engine bulletin No. 3 of the Goldie & McCulloch Co., Limited, Galt, Ont., describes and illustrates in detail their standard type of heavy duty corliss engines. It is 6 x 9 inches.

"One Day's Work" is the title of a neat little booklet issued by the Bullard Machine Tool Co., Bridgeport, Conn., illustrating their 42 inch standard turning and boring mill, and giving figures regarding its daily capacity on different kinds of work.

Engine Type Generators. Circular No. 1111, of the Canadian Westinghouse Co. Limited, Hamilton, is devoted to direct current engine type generators. The different features are touched on in the usual Westinghouse style. It contains 11 pages, 7 x 10 inches.

The Westinghouse Companies in the Railway and Industrial Fields. This is a neatly gotten up sketch of what the Westinghouse interests have done in these fields. The illustrations and typographical work are exceptionally fine. Contains 67 pages, 10 x 8 inches.

Machinists' Annual. Is a neatly gotten up circular published annually by the Toronto branch of the International Association of Machinists at the time of their annual picnic. It is devoted to the sporting and amusement interests of the Toronto members. It is 6 x 9 inches.

Grinding Machinery. The general catalogue of the Canada Corundum Wheel Co., Hamilton, contains a detailed description of the emery wheels, corundum wheels and general grinding and buffing machinery made by this firm. It is well illustrated, and contains 75 pages, 6 x 9 inches.

Engineering Books. The June catalogue of engineering books, published by the McGraw Publishing Co., 114 Liberty street, New York. The illustrated catalogue of architectural, scientific, industrial and technical books published and imported, Wm. T. Comstock, 23 Warren street, New York, is also out. Thos. Reed & Co., Limited, 184 High street west, Sunderland, Eng., have issued a catalogue of books on marine engineering.

The Standard. This is the name given to a motor catalogue recently issued by the Robbins & Myers Co., Springfield, O. It is an exceptionally handsome and rather originally gotten up catalogue. There are alternately thick and semi-transparent sheets. On the thick sheets are illustrations of their motors, while on the semi-transparent sheets are printed letters of recommendation. Thus, the illustrations show up faintly through the semi-transparent sheets, giving a handsome effect. There are 35 pages, 10 x 8 inches.

Gauges. Newall Engineering Co., Warrington, England, have sent us a 25 page price list of their workshop gauges. The booklet is printed on best quality paper and is illustrated by excellent half tone engravings of the Newall gauge, micrometers, surface plates, etc. Another booklet issued by the same firm contains much interesting information regarding limits and limit gauges, showing their importance in measuring interchangeable work. The firm's Canadian agents are McLean & Sophus, 301 St. James street, Montreal.

Rawhide Gear Wheels. Machinists and mechanical engineers will be interested in the booklet on silent running rawhide gears, issued by David Brown & Sons, Huddersfield, Eng. The booklet contains forty pages and cover, and is most attractively illustrated. The cover is a violet shade and the general appearance is prepossessing. The facts and data given regarding rawhide gears will be found very instructive, and are well worth having. Mention Canadian Machinery when applying for this catalogue, to McLean & Sophus, 301 St. James street, Montreal.

Forges and Blacksmiths' Tools. The 1905 edition of the Canadian Buffalo Forge Co.'s catalogue, is a comprehensive little booklet of neat size, containing 247 pages of reading matter concerning the many lines of hand blowers, portable forges, blacksmiths' drills, punches, steam pumps, etc., manufactured by this firm. The whole is profusely illustrated. The cover is heavy red paper, embossed with black and white. All interested in this catalogue may obtain a copy by mentioning Canadian Machinery, and applying to the Canadian Buffalo Forge Co., Montreal.

FAIRBANKS-MORSE NEW PLANT.

Construction is to commence at once on the first three buildings of the new Canadian manufacturing plant of the Canadian Fairbanks-Morse Mfg. Co., Limited, at Toronto. A splendid site, comprising ten acres of land, has been secured south of Bloor street and between the Grand Trunk and Canadian Pacific Railways, about half a mile south of the Canada Foundry Co.'s works. Plans of the buildings have been prepared, and Mr. Fuller, president of the company, was in Toronto recently completing the necessary arrangements to allow the work to proceed at once.

The buildings to be gone on with at present include a machine shop, 288 x 100 feet, with galleries 24 feet wide on both sides the entire length of the building; a foundry, 72 x 180 feet; a blacksmith shop, 72 x 98 feet; and a power house, 60 x 80 feet. The material to be used in all the buildings will be reinforced steel concrete, the contract calling for the completion of the buildings by October 15. All buildings will be built with blind ends to permit of their being extended as the requirements of the business demand.

It is the intention to manufacture practically the full line popularized by the Fairbanks-Morse Co. in the past, as well as many new lines, but it will be impossible to realize these plans from the outset. The product of the plant at first, therefore, will consist of Fairbanks-Morse gas engines, steam pumps, hand cars, stand pipes, and other railway supplies, the output being handled exclusively by the Canadian Fairbanks Co., Limited. Mr. Geo. W. Sparks, of Fairbanks, Morse & Co.'s plant at Beloit, Wisconsin, will be manager of the factory.

Machinery Development

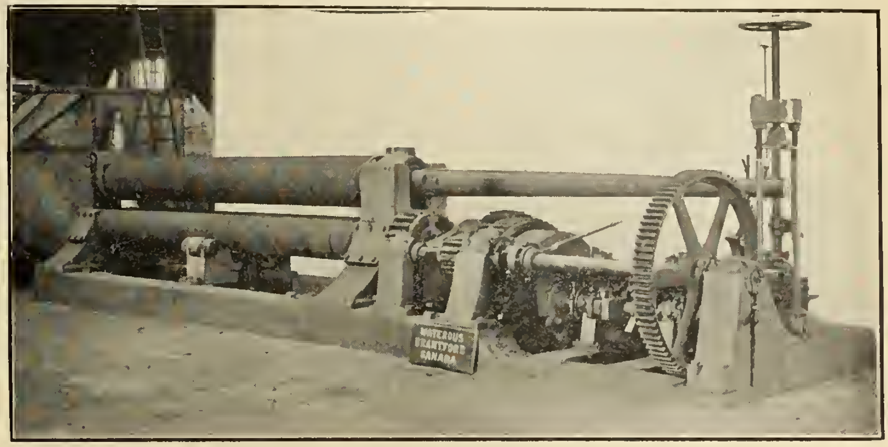
Metal Working **Special Apparatus** **Wood Working**

A LABOR-SAVING MACHINE.

A CEMENT concrete mixer, manufactured by the Goold-Shapley & Muir Co., Limited, Brantford, is a recent development which the demand for concrete work in large quantities has made possible. The machine, as will be seen from the illustration, is mounted on a truck which contains likewise a prime mover to operate the machine, the entire apparatus being automatic. It has a capacity of mixing 75 yards of concrete per day. The gravel hopper is low down so as to be easy of access to the operator who is shovelling in the material. On top of the machine above the gravel hopper is placed another hopper which holds the cement, when the desired quantity of gravel is in the hopper for this purpose it is tripped by means of a lever and is raised up until the gravel dumps into the large main drum of the mixer and as this gravel hopper if being raised it automatically turns a cylinder which is in the bottom of the cement hopper and the cement is dumped in with the gravel into the long drum. This cylinder under the cement hopper is so arranged that it can be set to dump cement in any desired proportion from 12 to 1 to 2 to 1, and will automatically do this until the adjustment is changed making a new mixture.

A Labor-Saving Machine.

The mixture is mixed dry in the revolving drum until it reaches about one-third of the length of the drum and at this point there are cups on the outside of the long drum which in revolving pass through a trough placed under the drum of the mixer and take up sufficient water which flows out into the centre of the drum to properly moisten the mixture. This water is also automatically put into the mixer by means of a stop cock being opened under the supply tank, which is also placed on top of the machine, and when the gravel hopper is elevated it opens the stop cock allowing the water to flow down from the tank into the trough below, and the quantity can be regulated at will. The water is pumped up into the tank by the engine which operates the mixer, which is a gasoline engine, also manufactured by Goold, Shapley & Muir Co., and the same pump circulates the water round the cylinder of the engine keeping it cool and the water is then delivered to the tank above. Naturally this pump forces more water into the tank than is required and an over-flow back to the barrel or tank in which the water is stored is supplied making the water supply continuous and regular.



Heavy Plate Rolls.

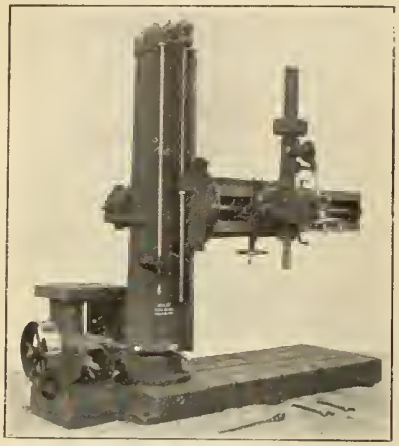
HEAVY PLATE ROLLS.

ILLUSTRATIONS of plate-bending rolls recently installed by the Waterous Engine Works, Brantford, in their boiler shop are shown. This machine was designed and built by them to meet the demand for increased equipment caused by large increases in business.

It will be noticed that the design is very heavy and massive, the weight being in the neighborhood of 40 tons. The size of largest plate this particular machine will handle is $1\frac{1}{4}$ in. by 14 ft. The top roll is 18 in. diameter, bottom rolls 14 in. diameter, one of the latter having a groove cut full length to enable flanging of straight pieces to be done on the machine. The rolls are driven by a 26 h.p. double engine through cast steel gears and clutch. The top roll raising and lowering device is driven by frictions off the engine shaft as shown. Reverse is obtained direct from engine. The outer bearing for top roll may be raised independent of the others. Cast steel enters largely into the construction of this machine. The Waterous Engine Works are in a position to place this machine on the market in different sizes.

NEW NILES RADIAL DRILL.

THIS machine is the result of the experience of Niles-Bement-Pond Co.'s five works in the design and manufacture of radial drills. It is built to use high-speed drills to their fullest capacity. The drill head saddle fits between as well as outside of the arm guides, which completes the double box



New Niles Radial Drill.

section of the arm and insures great rigidity. The column saddle is strongly gibbed to flat scraped bearings on the column and the post about which the column revolves extends to the extreme top of the sleeve. The use of large shafts, steel gears, bronze bushings and ring oiling bronze bearings for all fast-running shafts, makes a strong, durable machine capable of standing the hardest service. The principal feature, however, of this machine is its convenience and ease of manipulation. All the feeds and speeds are changed by means of levers, and great care has been taken to arrange the levers and hand wheels, so that they shall be within easy reach of the operator. The column rests on ball bearings. An idea of the simple, compact design of the machine can be gained from the photograph.

The machine is adapted for use with either carbon or high speed drills, the range of spindle speeds being sufficient for this purpose. Friction clutches are used for starting and stopping the machine at high speeds, so as to prevent shock and consequent wear. The speed box is planed on the top, in order that the drill may be easily changed from a belt-driven machine to a motor-driven machine, by the simple substitution of two gears for the pulley. Reversing gears for tapping are provided. All speeds and feeds may be changed while the machine is running even at its highest speeds.

This radial drill is a full universal machine, that is, both the arm and the saddle swivel. This fact should be borne in mind in considering the design. Dimensions of machine are as follows: Drills to the centre of, 12 ft.; maximum distance from face of column to centre of drill, 77½ in.; least distance from face of column to centre of drill, 22½ in.; greatest distance from spindle to base plate, 72 in.; traverse of spindle, 20 in.

BOLT AND NUT MACHINE.

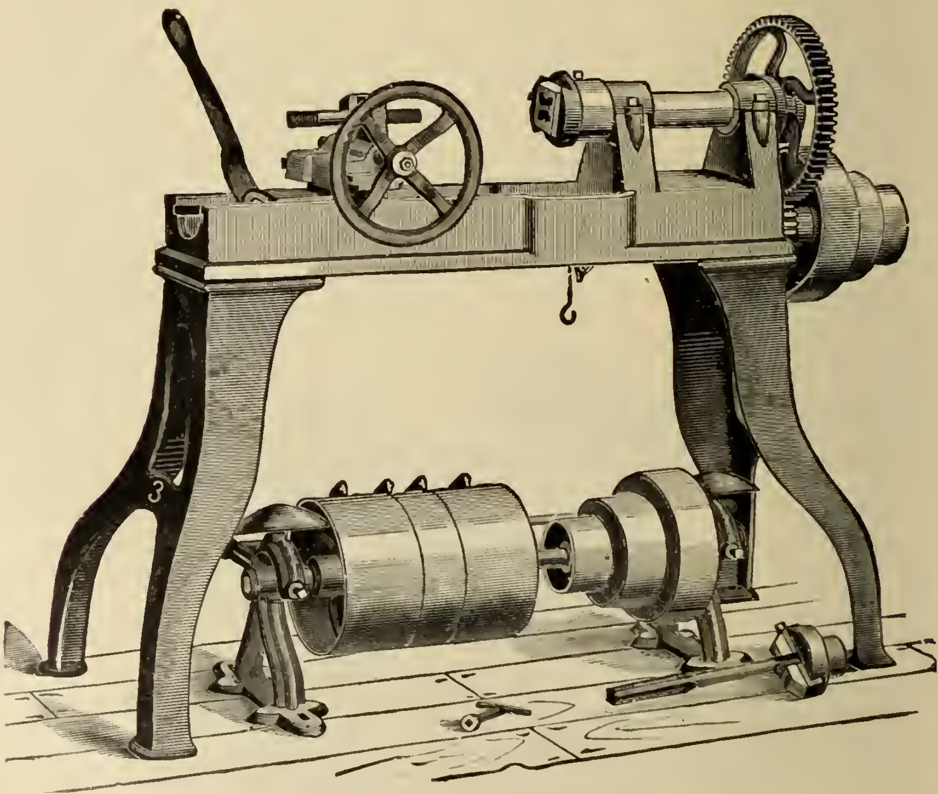
THE accompanying cut illustrates an extremely useful machine, built by Boynton & Plummer, Worcester, Mass., U.S.A., for threading bolts and tapping nuts.

They are built in several sizes, either for hand or power and also for hand and power combined.

It is claimed that with these machines large-sized bolts can be threaded with greater ease and facility than with any other of similar make, while small sizes can be cut as rapidly as with a small machine.

A very desirable feature of these machines is that they are constructed to accomplish the work intended with the least number of parts to get out of repair, of any tool of its kind.

With these machines they furnish taps and dies for rough iron sizes, that is, 1-32 large and V thread. Either solid or adjustable dies are furnished as desired.



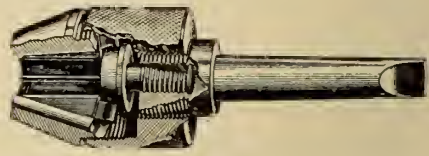
Bolt Tapping and Nut Threading Machine.

This company also manufacture a complete line of desirable machines for use of blacksmiths, carriage-makers, repair and machine shops, such as drills, forges, tire benders, tire shrinkers, bolt heading machines and shaping machines, and all machines of their manufacture are offered to the public as standard of their class.

They are receiving constantly testimonials from users of their machines all over this country and in foreign lands, of which volumes could be made, as to the reliability and general satisfaction of the output of their works.

NEW DRILL CHUCK.

THE BUTLER CHUCK CO., Greenfield, Massachusetts, are putting upon the market a new principle applied to a drill chuck, of which the accompanying open cut gives a very good idea.

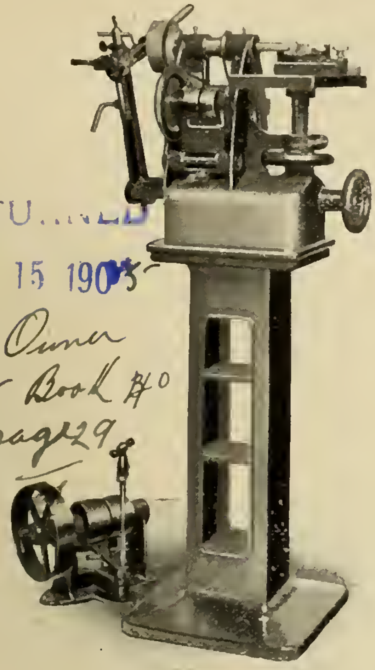


Butler Drill Chuck.

The plan of driving the drill by the screw which actuates the clamping mechanism was early adopted and was applied to one of the earliest patents which came into general use, but the friction of the driving head against the base of the jaws was soon found to overcome the screw pressure and there it would stop in its tightening operation and the drill turn in its socket.

Different plans for bringing the driving plug in contact with the base of the jaws were tried at various times, but the results varied but little, at last the

Butler people hit upon the plan of a traveling plug, which not only eliminates the friction but doubles the screw power.



Tap and Die Grinder

It is said by those who use it, to be a very strong chuck, so much so that several who are using the large sizes have notified the firm that they are about abandoning the use of taper shank drills. The firm would be glad to furnish reference to any who may be interested or send out the large sizes on 30 days' approval.

The largest size at present ready for the market is one holding 1-inch drills.

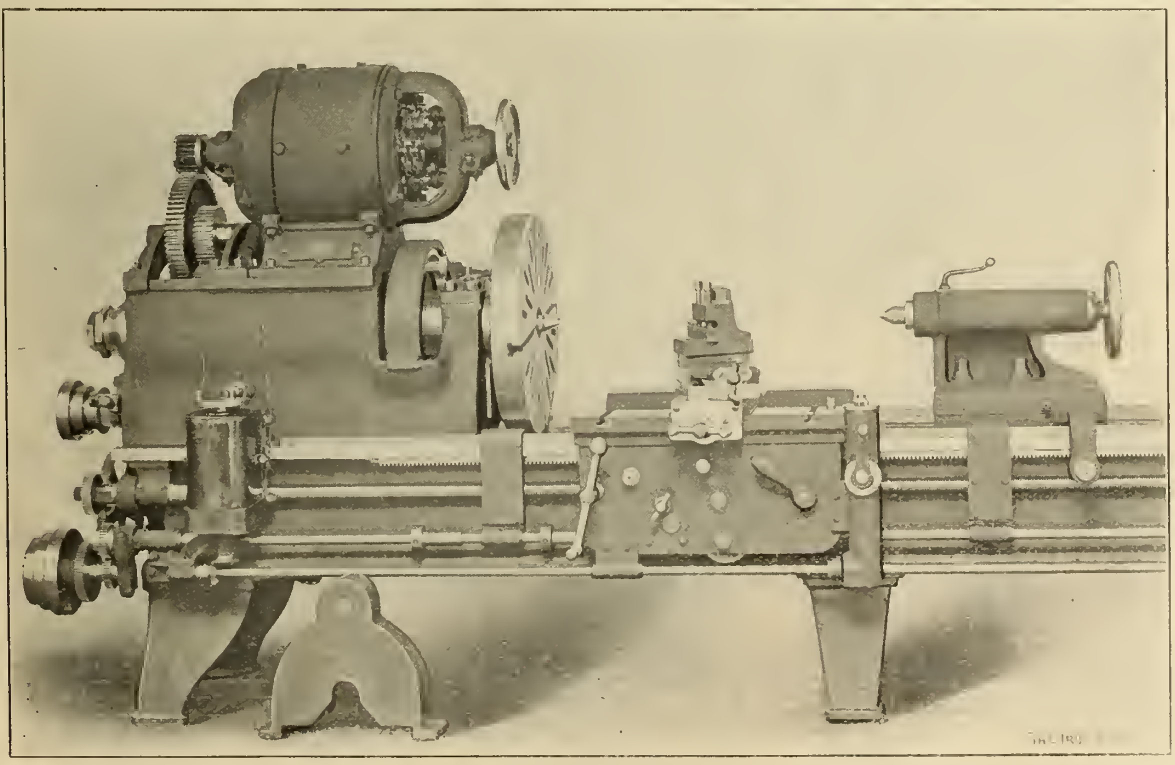
TAP AND DIE GRINDER.

A RECENT product of the works of the Greenfield Machine Co., Greenfield, Mass., is a tap and die grinder embodying new features. The tap-sharpening attachment consists of two centreheads mounted on a swinging arm, which carries the tap across the face of the cup emery wheel. The arm swings at an angle with the face of the wheel, permitting the tap to be ground at any angle. The tap is indexed by means of a rigid tooth rest and held in place on centres, one of which is attached to a spring lever, allowing the tap to be removed quickly. Means are provided for holding a tap, which has the end broken off, or one without centre holes as shown in cut below. The work is brought towards the wheel by means of the hand wheel at the front of the machine. Chucking reamers can also be ground on this fixture. Will hold from $\frac{3}{8}$-inch hand taps to $1\frac{1}{4}$-inch machine taps.

MOTOR DRIVEN ENGINE LATHE.

A NEW type of motor-driven lathe, built by F. E. Reed Co., Worcester, Mass., is shown in the accompanying illustration. The lathe differs from that which this company have previously built for motor drive in that all rocking gears are dispensed with as well as chain drive. All shafts are fixed, the drive being sirect from the motor pinion through a chain of gears to the spindle. The General Electric Co.'s C. R. type of variable speed reversing motor has been adopted for this lathe, the speed variations of the motor being from 500 to 1,500 revolutions per minute. Twenty forward speeds are obtained directly from the motor to the spindle, and ten reversing speeds, that number providing sufficient variations with the same extreme ranges. The lathe is double back geared, so that 20 additional speeds are obtained through each of the back gears, making a total of 60 forward and 30 reversing speeds, the variation being from 7 to 200 revolutions per minute of the spindle. The ratio from motor to spindle on the direct drive is 7.75 to 1, and 23.25 to 1 and 69.75 to 1, respectively, for the two back gear drives. These speeds are on the basis of a cutting speed of 50 feet per minute.

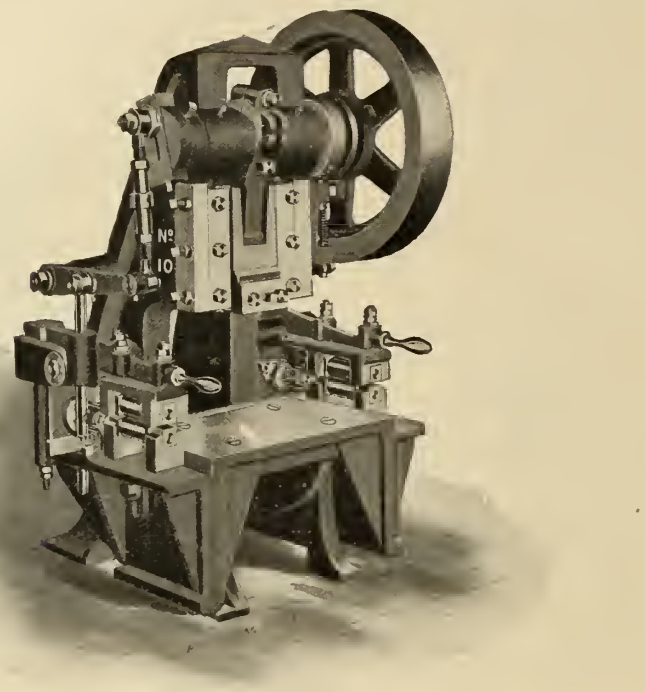
The lathe is equipped with a convenient device for handling the speeds, which is of importance where large lots of the same size of piece are to be worked. The controller, located at the side of the head directly below the motor, is operated from a reversing box fastened to the right hand side of the apron, the connection being through bevel gears and shaft. The dial of the reversing box on at which there is no electric connection. ward and reversing, and for the point the apron is marked for each speed, for-



Reed Motor Driven Engine Lathe.

SPECIAL FEED BLISS PRESS.

IN the accompanying half-tone is illustrated a very compact little machine with a special automatic double-roll feed, designed for cutting the teeth on band saws. The feed is adjust-



Special Feed Bliss Press.

able and will cut either a coarse or fine tooth from 16 points to the inch to 4 to the inch, common teeth.

An important feature of the press is the construction of the feed rolls, which are open at the end, allowing of readily inserting and removing the stock. The two small hand levers shown are used for raising the rolls prior to starting a new strip of stock or for removing an old one. The feed will permit of a wide range of adjustment, which is effected by sliding the connection on crank shaft up and down a "T" slot, which holds it securely in place. This sliding adjustment is controlled by a set-screw, which easily moves it to the desired location. The press has a 1-inch stroke, with an adjustment of 1-inch. The distance from bed to slide when stroke is down and adjustment up is 7½ inches. The fly wheel weighs 115 pounds and is run at 300 revolutions per minute.

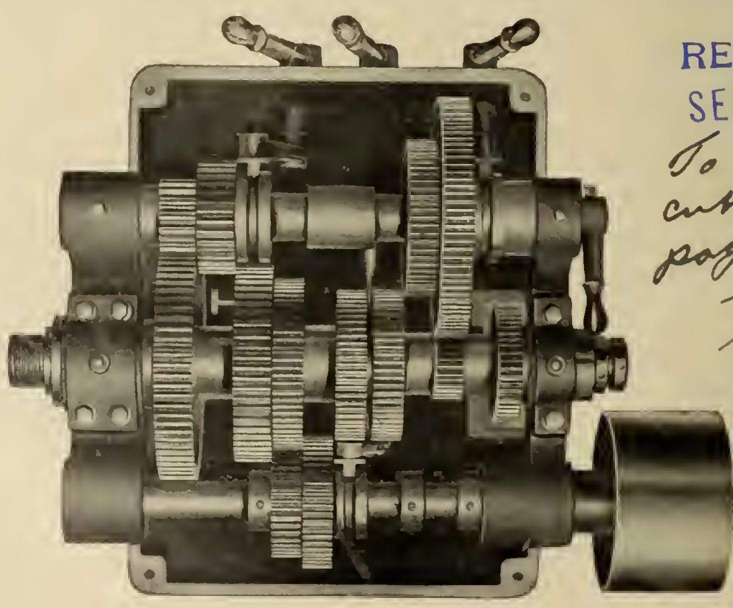
This press has been built by the E. W. Bliss Co., 43 Adams street, Brooklyn, N.Y.

DRAPER GEARED HEAD LATHE.

MODERN conditions of manufacturing have so changed the demands upon machine tools that the older patterns are already fast becoming obsolete, and in no department is this more noticeable than in lathes. The higher rate of surface speed permissible with the tool steels at command call for a multiplicity of speed changes in order that all diameters may be kept approximately at the desired speed. The design should also be such as to permit the application of a motor drive without radical changes in construction, so as to use the 2 to 1 variable speed motor, or with the growing use of alternating-current motors, which are constant speed and at present are not recommended as variable-speed machines, a sufficient number of mechanical speed changes are necessary. The Draper patent geared head lathe, made by the Draper Machine Tool Co., Worcester, Mass., shown in illustrations, combines these desirable features. The half-tones show the 18 in. patent geared head as arranged for belt drive. This lathe is driven by a wide face pulley with a 6-inch belt, giving 10 geared speeds to the spindle, obtained by sliding gears operated by the levers shown, and is constructed to withstand the most severe duty, having power either for heavy reduction or fast cutting speeds for finishing cuts. There is also shown an interior view of the head with the cover removed. The method of operation is made very plain by these views.

The driving shaft is at the back of the lathe on which is mounted two sliding gears, operated by the middle lever at the front of the head. These gears mesh in either one of the two gears shown on the sleeve running loose on the main spindle. The front countershaft with its four gears is operated as is the back gear shaft on the usual lathe. By throwing out these gears with the eccentric, and locking the spindle train with the knob shown in the cut, there are two rates of speed obtained. With the spindle gears disconnected and the front countershaft or back gear shaft thrown in mesh there are eight more spindle speeds, making ten in all, with the single speed countershaft or the constant speed motor. The belt-driven lathe is usually furnished with the two-speed countershaft, which in this case gives twenty forward working speeds to the spindle, and in order to avoid the complication of a backing belt the dial thread indicator shown at the right of the carriage is furnished, permitting all screw pitches regularly cut to be readily caught without a backing belt.

The lathe, as illustrated, gives three changes of feed, or screw pitches, with-



Lathe Head with Cover Removed.

out change of gears. This lathe can be made with the Draper quick change feed in the apron, giving forty changes of feed or screw pitches without change of

gear. The illustration of the lathe shows same with pan, which is quite frequently furnished with the lathe, owing to the greater amount of work that can be obtained with the high-speed tool steels when using a lubricant. The lathe, however, is made with or without pan as desired. This lathe is also made with double independent block with setover to front block for splitting the cut when desired.

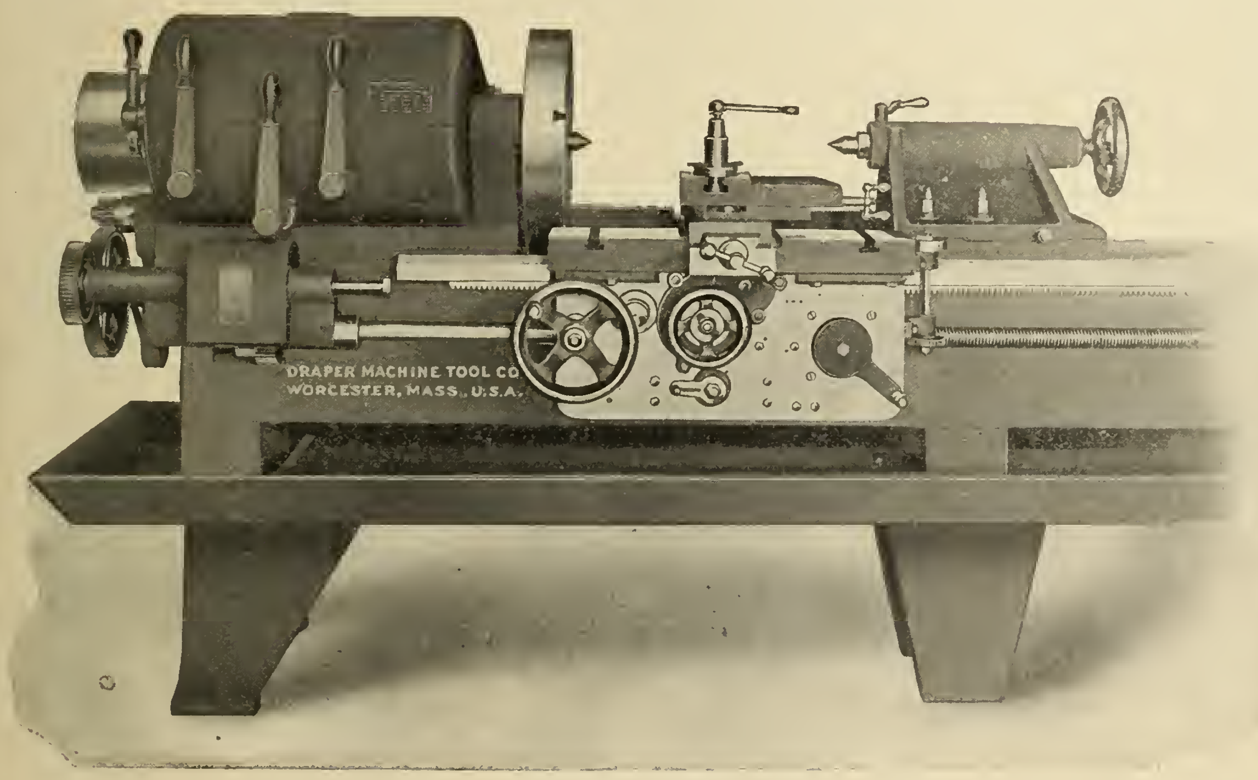
THE EVOLUTION OF STEEL.

POWDERED charcoal dissolves as fast as it falls when dropped on seething iron in a crucible and forms steel, the most useful alloy known to art. When the proportion of carbon is about one-sixtieth, the steel has double the strength of the iron it was made from; as the carbon is varied in quantity, the steel takes on just the hardness, toughness, or elasticity desired. So highly did our forefathers prize steel for their weapons and tools, that they produced it at an outlay tenfold that required for iron. Of course, at such a price, the field for steel was strictly limited, much as the demand for silver is now. But less that fifty years ago, or, to be exact, in August, 1856, Bessemer announced his famous process for making cheap steel, and the industrial world entered upon a new era. His plan was simplicity itself. Cast iron contains much more carbon than does steel, and he burned away this redundancy with a powerful blast of air. In practice, he found it best to burn out pretty much all the carbon, and then add to the molten metal a measured quantity of carbon, which would give him just the alloy he wished. This accomplished, at the end of much brave and patient toil, steel fell to a price so low that it soon began to take the place of iron for railroad tracks, for ships, boilers, engines, machinery of all kinds, of a new durability, and made feasible an increase of working speed all along the line. Within the past twenty years, steel has been adopted for office buildings, hotels, bridges, elevators and the like, with the effect of almost completely revolutionizing the arts of design and construction. And no wonder, when we see that to-day at Pittsburg No. 1 Foundry Iron brings a price only a fraction less than steel billets.

English iron ores usually contain phosphorus enough to render their metal, unless specially treated, so brittle as to be of small value. This difficulty harassed the English iron-masters for more than twenty years after a remedy had been suggested. Within a month of Bessemer's announcement of his process, Dr. R. H. Collyer paid a visit to the inventor's furnace, proposing that dry lime in powder be added to the metal so as to form a phosphate which would pass away with the slag. It was not until 1878 that this idea was carried into effect by Sidney Gilchrist Thomas, a young fellow of twenty-seven, with the effect of immensely increasing the value of irons and steels produced from ores carrying phosphorus.

All the gain in tenacity secured when steel takes the place of iron is repeated when steel, in its turn, is alloyed with nickel. If this metal were cheap, we should at once have thinner boilers, bigger steamships, higher towers, bolder bridge-spans, while every factory wheel would turn one-half quicker than to-day. Like many another group of alloys, nickel steels change their behavior in a remarkable fashion as the percentage of their ingredients is varied. With fifteen per cent. of nickel the compound is extremely sensitive to changes of temperature, expanding much with a single degree of added heat. But this characteristic vanishes as the proportion of nickel is increased. Mr. C. E. Guillaume, of the International Bureau of Standards, at Paris, has united 36.2 per cent. nickel with 63.8 of steel to form an alloy which he calls "invar." When warmed one degree of the Centigrade scale, this alloy expands only one-millionth part, that is, just one-eleventh as much as ordinary steel. "Invar," accordingly, is adopted for standards of measurement, for surveying instruments, and is likely to be in extensive demand for time-pieces, telescopes, cameras and all other mechanism in which precision is of prime importance.

Indifference to heat in another alloy of steel was long ago noticed by Mr. Robert Mushet, of Sheffield. He found that when he added tungsten to steel he had a material of amazing toughness, which withstood temperatures that destroyed the temper of other steels.



Draper Patent Geared Head Lathe.

Companies Incorporated

The surrender of the charter of the Perth Electric Light Co., Limited, has been accepted.

The Wallaceburg Brass & Iron Mfg. Co., Limited, has been incorporated with a share capital of $40,000.

The Windsor & Cobalt Mining Co., Limited, have been incorporated with a share capital of $150,000.

The Horse Shoe Quarry Co., Limited, have been granted the right to increase their share capital from $40,000 to $100,000.

The Dominion Natural Gas Co., Limited, have been granted the right to increase their share capital from $500,000 to $1,000,000.

The Power & Gas Machine Co., Limited, of Galt, have been incorporated with a share capital of $100,000, purpose manufacturing gas, steam and air engines and incidental machinery, etc.

Concretes, Limited, of Toronto, have been incorporated with a share capital of $40,000, for the purpose of constructing roadways, sidewalks, buildings, etc. The directors are C. Curtis, W. H. Peppin, and J. A. Milne, all of Toronto.

Johnston Oil Engine Co., Limited, Toronto, share capital $250,000; purpose, to manufacture engines and motors. The directors are: H. A. Johnston, A. M. Wickens, O. Jull, C. M. Watts, all of Toronto, and W. F. Johnston, of Ingersoll.

Monarch Brass Mfg. Co., Limited, Port Colborne, share capital $100,000; purpose, to manufacture brass goods, plumbers' supplies, etc. The directors are: C. A. Masten, J. R. L. Starr, J. H. Spence, S. Whittaker and L. M. Heal, all of Toronto.

The Guelph Stove Co., Limited, of Guelph, share capital $200,000, purpose to manufacture and deal in stoves, furnaces, boilers, heaters and metals of all kinds. The directors are J. Brown, M. Kelly, F. Nunan, C. Kloepfer, and F. T. Coghlan all of Guelph.

General Explosives Co., of Montreal, Limited, share capital $20,000; purpose, to manufacture explosives of every description. The directors are: R. L. Dillon, Montreal; J. McMartin, Cornwall; E. A. Lesaeur, N. W. Drummond, and J. F. Orde, all of Ottawa.

Concrete Pole Co., Limited, St. Catharines, share capital $100,000; purpose, to manufacture concrete poles and other materials. The directors are: J. Jennings, H. L. M. Weller, of Toronto; E. J. Odlum, H. H. Collier and J. B. Burson, all of St. Catharines.

The Ontario Transmission Co., Limited, Niagara Falls, Ont., have been incorporated with a share capital of $1,000,000, for the purpose of developing water power, etc. The directors are J. S. Lovell, W. Bain, E. W. McNeill, S. G. Crowell, W. F. Ralph, all of Toronto.

Sur-Coat Mfg. Co., Limited, Windsor, share capital $10,000; purpose, to manufacture chemical compounds for preserving metals and other plumbers' supplies. The directors are: C. T. Askin, Windsor; T. Hurley, J. T. Hurley, D. M. Hurley and J. H. Walsh, all of Detroit.

Ontario Gas & Fuel Co., Limited, Hamilton, share capital $100,000; purpose, to develop natural gas property. The directors are: F. M. Lowry, J. C. McDowell, of Pittsburg, Pa.; W. A. Spratt, of Hamilton,; W. J. Aikins, of Dunnville, and C. A. McGara, of Dundas.

Corrogated Concrete Pile Co., of Canada, Limited, Montreal, share capital $50,000; purpose, to do construction work. The directors are: V. E. Mitchell, D. Armour, A. C. Casgrain, C. M. Cottom, S. Lehura K. J. Beardwood, and L. L. Legault, all of Montreal.

The Bond Hardware Co., Limited, of Guelph, have been incorporated with a share capital of $100,000, for the purpose of carrying on the business of hardware merchants. The directors are: J. M. Bond, W. G. Bond, T. A. Keating, J. S. Millar, and F. R. Bond, all of Guelph.

The Toronto Sand Lime Brick Co., Toronto Junction, have been incorporated with a share capital of $40,000, for the purpose of manufacturing brick and doing a general business in sand, lime, gravel, cement, etc. The directors are G. H. Large, J. Schultz, and J. S. Proctor.

The Toronto Launch and Engine Co., Limited, of Toronto, have been incorporated with a share capital of $40,000, for the purpose of dealing in boats, launches, steam and gasoline engines, etc., and to take over the engine patents and applications for patents from J. C. McLachlan.

Northern Construction Co., Limited, of Montreal, have been incorporated with a share capital of $100,000, for the purpose of constructing private and public works of any kind. The directors are: E. M. O'Brien, J. B. Rose, E. C. Perkins, G. A. Lafontaine and W. S. Stavely, all of Montreal.

The Dominion Automobile Co., Limited, of Toronto, have been incorporated with a share capital of $100,000, for the purpose of manufacturing and dealing in automobiles, motor boats, etc. The directors are: A. H. Beaton, C. L. Wilson, J. McArthur, J. Barber, and C. E. Holland, all of Toronto.

The Steel Concrete Co., Limited, of Montreal, have been incorporated with a share capital of $200,000, for the purpose of carrying on a business as engineers, contractors, etc. The directors are: J. L. Harrington, E. A. Wallberg, and W. F. Boggis, of Montreal, and H. Fisher and J. Murphy, of Ottawa.

Ingersoll Nut Co., Limited, Ingersoll, share capital $25,000; purpose, to carry on business as engineers, machinists, founders, bolt, screw and nut makers, etc. The directors are: J. A. Coulter, Ingersoll; W. H. Shapley, Toronto; F. H. Deacon, Milton; O. E. Robinson, Ingersoll, and W. R. Wortman, London.

Last year the iron works at Han Yang, China, turned out more than 35,000 tons of steel rails, which were sold at an average price of $31.37 a ton. The output of pig iron was increased from 120 to 170 tons a day. The iron works employed five foreigners as managers and overseers and over 3,000 native workmen.

The Maritime Art Glass Works, Limited, St. John, N.B., have been incorporated with a capital of $25,000, to acquire the business of the Maritime Art Glass Works, and to manufacture mirror plate, prism lights, etc. The provisional directors include Archibald Bauer, W. C. Bauer, and J. A. Bauer, St. John.

Banner Oil Co., Limited, Petrolea, share capital $100,000; purpose, to explore for and deal in natural gas and petroleum, and to manufacture and deal in well drilling tools and machinery. The directors are: J. C. Winters, Mount Morris, N.Y.; C. H. Palmer, Rochester, N.Y., and D. S. Robb, London, Ont.

Western Counties Electric Co., Limited, Brantford, share capital $500,000; purpose, to manufacture and sell electric power. The directors are: S. F. McKinnon, J. N. Shenstone, C. G. Harstone, all of Toronto; J. Knox and C. S. Scott, of Hamilton; H. Barber, Toronto, and A. T. Duncan, of St. Catharines.

The Stratford Fuel, Ice Cartage & Construction Co., Limited, Stratford, share capital $100,000; purpose, to manufacture and deal in fuel, ice and building and construction material. The directors are: M. Lachlan Leitch, of London, Ont.; W. J. Mooney, C. E. Nasmyth, S. J. Cook, and J. J. Coughlin, all of Stratford.

The Dunnville Mutual Natural Gas Co., Limited, of Dunnville, share capital $15,000; purpose, to construct and operate works for the production and distribution of natural gas for purposes of light, heat and power. The directors are: W. H. Penny, W. E. Traver, C. D. Trimble, G. Reid, and O. E. Willson, all of Dunnville, Ont.

The Monarch Supply Co., Limited, Toronto, have been incorporated with a share capital of $6,000, for the purpose of operating works for the production, sale and distribution of electricity for purposes of light, heat and power. The directors are: J. S. Lovell, W. Bain, R. Gowans, W. W. McNeill, and W. F. Ralph, all of Toronto.

Eastern Coal Co., Limited, of Toronto, have been incorporated with a share capital of $500,000, for the purpose of carrying on the business of a mining, milling, reduction and development company. The directors are: J. S. Lovell, E. W. McNeill, R. Gowans, S. G. Crowell and W. H. Blake, all of Toronto.

Ogden Oil Co., Limited, of Windsor, have been incorporated with a share capital of $50,000, for the purpose of mining and boring for oil, gas and other mineral products, etc. The directors are: W. W. Taberner, of Chicago, Ill.; F. Rehm, of Detroit, Mich.; J. W. Hanna, J. Wigle, and J. R. Dixon, of Windsor.

The Loughborough Mining Co., Limited, of Sydenham, have been incorporated with a share capital of $10,000, for the

purpose of carrying on the business of a mining, milling, reduction and development company. The directors are: M. F. Westover, E. Clark, D. M. Barton, and A. H. Jackson, all of Schenectady, N.Y.; and G. W. McNaughton, of Sydenham.

The Spider Lake Mining Co., Limited, of Windsor, have been incorporated with a share capital of $1,000,000, for the purpose of carrying on the business of a mining, milling, reduction and development company. The directors are: H. D. Keller, A. H. Rochey, J. E. Burgess, C. L. Brumme, all of Detroit, and A. R. Bartlet, of Windsor.

The Canadian School of Scientific Salesmanship, Limited, of Winnipeg, has been incorporated with a share capital of $90,000, for the purpose of educating pupils in science and the art of scientific salesmanship, etc. The directors are: L. S. Weber, M. C. Bowman, N. C. Bowman, I. S. K. Weber, all of Berlin, and E. O. Weber, of Winnipeg.

The London Pressed Stone & Concrete Co., Limited, of London, have been incorporated with a share capital of $40,000, for the purpose of manufacturing and dealing in all kinds of cement blocks, artificial stone, bricks, etc. The directors are J. Nicholson, J. C. Judd, E. A. Shoebotham, H. F. Whetter and T. C. Knott, all of London.

Wallingford Bros., Limited, of Ottawa, have been incorporated with a share capital of $45,000, for the purpose of carrying on the business of a mining, milling, reduction and developing company. The directors are: F. Cornu, of L'Ange Gardien, Quebec; E. Wallingford, F. S. Shirley, the Hon. Napoleon Antoine Belcourt, and M. I. Hickson, all of Ottawa.

The D. M. Stewart Manufacturing Co., of Canada, Limited, has been incorporated with a capital of $40,000, for the purpose of manufacturing gas burners, electrical insulators, etc. The directors are C. S. Steward, Chattanooga, Tenn.; W. H. Frazier, S. L. Ezell, A. J. Thomson and S. Johnson, all of Toronto.

The George Taylor Hardware Co., Limited, of New Liskeard, have been incorporated with a share capital of $40,000, for the purpose of carrying on the business of general merchants and to purchase the stock and trade of Messrs. Taylor Bros., of New Liskeard. The directors are: George Taylor and W. A. Taylor, of New Liskeard, and George E. Taylor, of London.

The Ontario Transmission Co., Limited, of Niagara Falls, Ont., have been incorporated with a share capital of $1,000,000, for the purpose of developing water and other powers for the production of electric, steam, pneumatic, hydraulic or other power or force. The directors are: J. S. Lovell, W. Bain, E. W. McNeill, S. G. Crowell, W. F. Ralph, all of Toronto.

The Beaver Mica & Mining Co., Limited, of Sundridge, have been incorporated with a share capital of $50,000, for the purpose of carrying on the operations of a mining, milling and development company. The directors are Joseph Pinkerton and J. J. Jackson, of Township of Strong District of Parry Sound; J. Herrgott, of Sundridge, and J. H. McCurry of North Bay.

The Canadian Fairbanks Co., Limited, has been granted power to increase their capital stock from $500,000 to $650,000. Kaministiquia Power Co., Limited, Fort William, share capital $2,000,000; purpose, to develop electric power for heating and lighting. The directors are: H. F. Holt, C. R. Hosmer, F. W. Thompson, H. W. Notron, all of Montreal, and F. H. Phippen, of Winnipeg.

The Universal Nut Machine Co., Limited, of Montreal, have been incorporated with a share capital of $200,000, for the purpose of manufacturing and dealing in machines for the manufacture of nuts, washers and other hardware. The directors are: A. Hendry and W. Eckenstein, of Montreal; C. A. Duclos, Westmount, H. L. Dinning, of Lachine, and C. Ralph, of Longueuil, all of the Province of Quebec.

The Coleman & Bucke Consolidated Cobalt-Silver Mining Co., Limited, Ottawa, have been incorporated with a share capital of $1,000,000, for the purpose of exploiting cobalt deposits in the Temiskaming mining division. It will carry on, in all its branches, the operations of a mining, milling, reduction and development company. The directors are W. H. Powell, J. McIsaac, J. J. Heney, F. R. Latchford, and A. A. Antoine, of Ottawa.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

POWER was turned on recently at the plant of the Wahnapitae Power Co. and active work will be commenced soon. The plant is established at the falls two miles below the Village of Wahnapitae, and the company have expended $100,000 in building and plant. They propose to develop 5,000 horsepower, and the expectation is that when the C.P.R. establishes a divisional point at Sudbury the company will furnish them with the power they need. In the meantime the Town of Sudbury will be supplied with power to operate its municipal electric light and water works system.

The St. John Globe is to build a five-storey office building.

The new chair factory in Listowel, Ont., is now running.

Frost & Wood are to erect a large warehouse at Edmonton.

The new Winnipeg Normal School building is now under way.

The Canada Glue Co.'s plant at Brantford is nearing completion.

An extensive cement plant is to be located at St. Peters, N.S.

The Standard Meter Co. are to erect a $10,000 factory in Toronto.

A patent wire fence factory is to be established at Emerson, Man.

The Cincinnati Typewriter Co. are looking for a Canadian location.

The Hewson Woolen Mills at Amherst, N.S., are extending their plant.

The Goderich Elevator & Transit Co. will likely rebuild their elevator.

Iron ore is being shipped from the mines at Calabogie, near Renfrew.

Morrison & McDougall are erecting a cement block store at Arcola, Assa.

A $50,000 elevator is to be built by T. Bullock & Son Crystal City Man.

A. P. McLeod is to establish a sash and door factory at St. Peters, N.S.

R. Thompson and R. Martin are erecting new residences at Fort Frances, Ont.

A wireless telegraph system is now in operation between Montreal and Québec.

The E. & N. Railway may be extended north from Nanaimo to Cumberland, N.B.

J. S. Richardson, Tilbury, Ont., has installed a new boiler in his planing mill.

The Canadian Northern Railway will build a spur line into Battleford this Fall.

Tacoma capitalists have secured a site for a $30,000 furniture factory at Vancouver.

A discovery of Bessemer iron ore is reported from Loon Lake, east of Port Arthur.

Within ten days, building permits to a total pf $47,725 have been issued in Edmonton.

About 100 single and twenty double houses are being built at Guelph this Summer.

New business-buildings to the value of $130,000 have been contracted for in Brandon.

Since March 1 building permits have been issued at Edmonton amounting to $341,695.

The Bank of Hamilton is to erect a modern fire-proof office building in Hamilton.

An effort is being made to boom Stocton, Maine, and make it a rival of St. John, N.B.

A rich gold strike is reported on the Copper River about 50 miles from Hazelton, B.C.

Work on the new buildings for the Wampole Mfg. Co., at Perth, has been commenced.

The Grand Valley Railway Co. will erect a station at Glenmorris in the near future.

The Boharm Elevator and Trading Co. will erect an elevator at Boharm, near Moose Jaw.

The N. Thompson & Co., machine shops at Vancouver, may re-open at no distant date.

A branch plant of the Vulcan Soot Cleaner Co., of Pittsburg, may be erect-

ed at Hamilton to supply the Canadian demand.

The Hamilton Bridge Co. have secured the contract to build a steel bridge at Owen Sound.

Work on the extension of the Intercolonial Railway station at St. John has commenced.

A large new store and office building is being erected for Joseph Maw on Main street, Winnipeg.

R. Beyers will build a brick house at the corner of Minto avenue and Huron street, Hamilton.

J. W. Woods, Ottawa, has bought a block of property in Hull on which to erect a factory.

Three men were killed in an explosion of dynamite in the Bank Head mine at Banff last week.

The McLaughlin Carriage Co., Oshawa, are to construct a five-storey brick block at Winnipeg.

Thos. Adams, Deloraine, Man., has disposed of his machine shop to J. D. McLeod, Stonewall.

The new tannery in New Westminster is now completed, and practically all the machinery installed.

The C.P.R. Co.'s Atlantic steamers made a profit of $200,000 during the year ending June 30.

Mr. Wm. Grayson has commenced the erection of a $12,000 one-storey brick block at Moose Jaw.

The C.P.R. is to extend its trackage at the coal towns of Frank, Blairmore and Coleman, Alberta.

The Edison Portland Cement Co. have increased their capital stock from $11,000,000 to $12,000,000.

It is announced that the G.T.R. will officially take over the Canada Atlantic Railway on September 1.

Sixteen new buildings have been erected, or are in the course of erection, in Treherne, Man., this year.

Loo Gee Wing, a wealthy Vancouver Chinaman, has contracted for a large hotel and theatre building.

Alterations at the City Hospital, Hamilton, will be commenced immediately and will cost $44,000.

The capitalization of the Britannia Copper Syndicate, Vancouver, B.C., is to be increased to $1,000,000.

Fraser Bros., Strathcona, Alta., have commenced the construction of the Coney Elevator at Ponoka.

The Great Northern Railway are to construct a depot at Fernie to replace the one burned down recently.

Ten thousand dollars have been appropriated by the M.C.R. to be expended on a new building in St. Thomas.

The railroads of the United States will consume probably 2,100,000 tons of steel rails in the calendar year.

Bulman Bros., Winnipeg, have definitely decided to rebuild. Their new structure will be seven-storeys high.

The Canada Steel Goods Co. has taken out a permit to erect a $5,000 cement and frame factory in Hamilton.

Ore averaging 63 to 67 per cent. of iron is being mined at Lepreaux, N.B., by the New Brunswick Iron Co.

The Merchants Bank have purchased a fine site at Arcola, Man., and will erect a three-storey brick block there.

The Western Commercial Co. are constructing a three-storey solid brick building, 50x80, in Riverdale, Sask.

Mining conditions in British Columbia are much improved and there is also great activity in the lumber industry.

A large factory to manufacture mining machinery is likely to be established at Vancouver by J. P. Smith, of Colorado.

The contracts have been awarded for building two more storeys to G. F. Stephens & Co.'s warehouse, Winnipeg.

Stratford has passed a by-law voting $30,000 as a loan to the Thread Mills, Limited, to aid in establishing a factory there.

A new mining district near Lake St. John, in Northern Quebec, is reported to be rich in gold, copper, asbestos and iron ore.

Barrie has had a record year in buildin $200,000 being spent, in addition to which the G.T.R. spent about $180,000 there.

John Hanbury, who owns sash and door factories at Brandon, Man., has just commenced the erection of a sawmill at Elko, B.C.

The St. Catharines tannery is to be enlarged, and a plant will be installed for the manufacture of high-grade leather shoe laces.

The Doty Engine Works, Limited, Goderich, Ont., have just shipped a marine engine to the Great Lakes Dredging Co., Port Arthur.

Concrete building blocks are being manufactured at Fort Frances, and a building is being erected of them for H. Williams.

The Marconi Co. are investigating the possibilities of operating between Fort William, Winnipeg, St. Paul, Duluth and Owen Sound.

The Sutton Lumber and Trading Co. propose to erect a large saw mill at Clayoquot on the western coast of Vancouver Island.

Ossington avenue Baptists, Toronto, will commence work on their new church in a couple of months. The building will cost $10,500.

The cut-stone front of the Gananoque Harness Works warehouse fell into the street and the building will have to be entirely razed.

A rich strike of copper ore, said to run from $60 to $90 per ton, has been made in the Britannia mine workings near Vancouver.

The R. C. Donald wood-working factory at Sunny Brae, N.B., has been taken over by the Le Blanc-Bourque Wood-Working Co.

The newly-organized Standard Wire Fence Co., Limited, of Woodstock, will be ready to commence operations some time in September.

Foley, Lock & Larson, wholesale grocers, Winnipeg, are erecting a five-storey structure to be utilized as a biscuit and confectionery plant.

A movement is on foot to build a Jewish synagogue at Berlin. It is likely that a large opera house will be erected there in the near future.

The Cushing Pulp Mill Co. has secured property at Kingsville, N.B., and will erect a small plant to prepare wood for use in the pulp mill.

Fowler's Canadian Co., Limited, Hamilton, a branch of the Swift Co., of Chicago, will enlarge their plant at a cost of about $70,000.

C. E. Benell, Brandon, has secured the contracts to construct a line of elevators for the Dowd Milling Co., on the Arcola branch of the C.P.R.

Contracts for the building of the enlarged Central Congregational Church, Winnipeg, have been let, the total amount being $22,000.

A Pittsburg Co. is said to be preparing plans for the erection of 300 houses in Hamilton, for the Canadian Westinghouse Co.'s employes.

The Canadian Metal Co. are progressing rapidly with their smelter at Frank, Alberta, and expect to be running by the 1st of September.

A company has been organized in Vancouver to manufacture the "All Right" extension ladder. A. P. May is president of the company.

The steel rail mill of the Dominion Iron & Steel Co. has been put on a double shift for the first time since it has been in operation.

The B. A. Pyrites Mine at Queensboro Hastings County, Ont., is developing an immense body of iron pyrites and is shipping ore to Buffalo.

Eri, Pa., capitalists have invested a large sum, said to be $50,000, in the Ontario Pipe Line Co., and will carry on the company's work.

Real estate sales in Montreal for first week in August reached a total of over $500,000, which is, so far, the best showing for any week this year.

Advices from the west state that the Kootenay district is now producing copper on a large scale, cheaper than anywhere else on the continent.

The new Kelly-Burnett block at Vancouver will cost $35,000. The Blue Ribbon Tea Co. will also erect a $26,000 building at the Terminal City.

Tenders for the construction of 27 miles of the Grand Trunk Pacific Railway on the main line west of Portage la Prairie have been called for.

The big Eddy saw mill at Revelstoke B.C., was burned to the ground last week. The loss will be heavy but the company intend rebuilding at once.

A public meeting of the Montreal Board of Trade will be held next month to consider the fire protection of the city and to suggest needed improvements.

A contract for the construction of two breakwaters at Rondeau harbor has been given to the Pacific Construction Co. The price is in the vicinity of $110,000

The Union Steamship Co. are to bring out a steamship from Scotland to ru

on the Montreal-Lake Superior line. It will be the largest freight boat in Canada.

N. R. Darroch, St. Thomas, has prepared plans for three-storey cement warehouse on Railway street for Joseph Griffin. Building will be 40 x 75 feet.

An English syndicate has purchased the Bruce Copper Mines in New Ontario for $1,000,000. A smelter will be built and 100 men employed from the start.

S. P. Hodgson, of Swan Lake, Man., has let the contract for a 100-barrel flour mill and 30,000-bushel elevator, to the Willford Manufacturing Co., Minneapolis.

The Keystone Sugar Co. have purchased the Whitby Harbor Co's. property for a consideration of $60,000. The sugar company thus have a most satisfactory site for their large beet sugar factory.

Seattle capitalists have a bond on a newly-discovered iron property at Ouatsino Sound, Vancouver Island, and are talking of establishing a $500,000 smelter.

The Sydney Cement Co., Sydney, N. S., have begun the manufacture of Portland cement. This is the first Portland cement manufactured in Canada east of Montreal.

Moncton, N.B., is enjoying the greatest building boom in the history of the city. New structures and improvements now under way make a total expenditure of $200,000.

The Keewatin Flour Mills Co., Limited, of Ottawa, have completed plans for the erection of a large fireproof milling and elevator plant to cost $750,000.

L. Bazin will construct a $4,000 building on Hermine street, Quebec, and Lieut.-Col. Boulanger will erect one to cost $3,500 on Champlain street of the same city.

The James Warnock Co., Galt, Ont., will devote all their factory space to the manufacture of tools, and will replace their spring plant with a modern tool plant.

The town of Whitby has voted a bonus to D. L. Holden, windmill and power pump manufacturer, Michigan, and he is now preparing to establish his plant in Whitby.

The town of Port Hope is considering the proposition of installing a municipal lighting plant for street lighting purposes. Electricity will be generated by water power.

Fraser Bros., Strathcona, have received the contract to build a 30,000-bushel elevator at Ponoka, and a flour mill and elevator for the Alberta Flour Mills Co. at Edmonton.

A recent addition to the industries of the west is the Moose Jaw Show Case Co., of which Mr. A. Radley, formerly of the Dominion Show Case Co., Toronto, is the head.

Arrangements have been completed for the erection of the Maple Leaf Flour Mills, with 2,000 barrels capacity, at Kenora, power to be taken from the Winnipeg River.

A large addition is being built to Gordon, Ironsides & Fares' abattoir, Winnipeg, and it is the intention of the firm to double the capacity of their establishment this year.

Elm Creek, Man., reports a building boom. Among the new structures are a brick school, $12,000; Anglican Church, $1,500; and several new dwellings, a total of $35,000.

Among the large buildings to be constructed at Guelph are the new C.P.R. station, to cost $40,000; the Homewood Sanitarium additions, $100,000, and the armory, $100,000.

The Electrical Development Co. of Ontario have decided to extend their line westward to London, touching at Brantford, Paris, Ingersoll, Woodstock and intermediate points.

Prospects at the mills of the Montreal Cotton Co., of Valleyfield, Que., are now very bright. Seven hundred and fifty additional looms will be put in operation next week.

An excellent coal pocket, known as the Wadsworth Mine, is being opened near Raymond, Alberta. A tunnel has been run 85 feet into the seam, which shows three feet of clear coal.

The new plant of the Canadian Shredded Wheat Co., Limited, was started in Toronto. Henceforth orders for the Canadian trade will be filled from this new Canadian factory.

The construction of the new Canadian Bank of Commerce Building, Prince Albert, has been awarded to Contractor Holmes. The building will cost in the neighborhood of $14,000.

J. C. Steckewreiter & Co. have opened up a general repair machine shop on Albert street, Berlin. They have installed several new machines. The shop is run by electric power.

Steel rails for the Guelph-Goderich extension of the C.P.R. are being sent out from the Soo works. They are of the 85-pound class, which insures a good roadbed for the new line.

Extensive alterations are being made at the School of Science building, Toronto. Work has also been commenced on the new convocation hall in connection with Toronto University.

The value of new buildings for which permits have been taken out in Hamilton this year amounts to $814,025. The value for July was $126,580, or $41,880 more than for July last year.

A new planing mill, to cost $100,000, is to be established at Douglaston, N.B., by Swedish capitalists, to export planed lumber for the English, Australian and American markets.

Over 3,000,000 logs will be brought down the Ottawa River this season by the Upper Ottawa Improvement Co. This is a much greater number than has been brought down for some years.

Stratford has decided to grant $30,000 to the C.P.R. to aid in purchasing a right of way to that city. The road is to be built by 1907 and to connect with the Goderich and Ingersoll branches.

Mr. C. E. Benell, of Brandon, has secured the work of erecting a 50,000 bushel elevator at Griswold, and is preparing the plans at his office. The elevator is for the Griswold Milling Co.

The Dominion Carriage & Bearing Co. Limited, will at once secure a charter, and erect a plant at Amherst, N.S. The capital of the company will be $200,000 with power to increase to $500,000.

An apartment house is about to be erected at St. John, N.B. Mr. D. R. Jack, who is pushing the scheme, has secured subscriptions for nearly all the capital stock, which has been fixed at $100,000.

Messrs. Mayhew and Gladstone, at the head of English capitalists, have obtained a free site from the Sydney, N. S., City Council for the $12,000,000 shipbuilding enterprise which they are promoting.

The large lumber and shingle mill of Small & Bucklin, New Westminster, B. C., is going up quickly. It is claimed that this will contain one of the finest planing and saw-mill equipments on the Pacific coast.

The Western Canada Cement & Coal Co., of which Sir Sandford Fleming and Premier Haultain are directors, are seeking subscription through the Royal Bank for £225,000 of 6 per cent. first mortgage bonds.

The manufacturers of Berlin, Ont., propose holding an industrial exhibition in October. A very large range of articles is made in that place and it is intended to exhibit every class and quality of goods turned out.

Two new furnaces will be in operation at the Granby Smelter after August 1, and the output of ore for the Boundary District for 1905 is certain to exceed 1,000,000 tons. Up to June 30 the tonnage was 450,000.

Messrs. Stetson & Cutter, a leading lumber firm of St. John, N.B., have taken a lease of the Mispec pulp mill at that place and will shortly instal new machinery to increase the capacity from 7,000 to 10,000 tons.

A large addition, 30x100 feet is being made to the factory of the Dominion Suspender Co., Niagara Falls. This will give them more floor space than any other factory in America manufacturing neckwear and suspenders.

L. H. Packard & Co., manufacturers of shoe dressing, etc., Montreal, have found their present premises on McGill street too cramped, and are planning to erect a new factory building 100 x 100 feet, on St. Antoine street.

Contracts for the factory building of the Cone Power and Gas Machine Co., Limited, have been let at Galt, and work has been begun on the building, which is 80x40 feet. The work will be put through with the utmost despatch.

The Northwest Construction Co., operating at the Newcastle Island quarries, at Nanaimo, has received a contract for stone for the United States navy drydock at San Francisco, requiring nearly 200,000 cubic feet of stone.

Three hundred men are at work installing a power plant at Kakabeka Falls, and the company hope to have electric energy available in Fort William this Fall. The foundation of the Ogilvie

mill at Fort William has been finished, and work on the superstructure begun.

The Canadian Fairbanks Co., of Montreal, in competition with other manufacturers, have secured a contract for power transmission material from the Dominion Government for their canal repair shop at Cornwall, Ont.

Mr. Townsend, of Louisburg, C.B., lately discovered peculiar stones near that town, which he believes are diamonds. The stones are represented as hard and transparent, and will cut glass readily and sparkle in a dark room.

H. A. Richardson will establish a peat-making industry at Winnipeg. He estimates that peat fuel produced by his patented process can be supplied to Winnipeg consumers at $5.50 per ton, and will compare favorably with anthracite.

Frederick Doty, of the Goderich Engine Works, has purchased the hull of the recently burned steamer City of Collingwood, and will rebuild it. The steamer Lincoln, burned at Sandwich two months ago, is also being rebuilt at the same place.

In spite of strikes in the building trades in Montreal, the month of July exceeded the same month last year by many thousands of dollars. The building has been mostly of a residential character in the north and west ends of the city.

Work on the construction of the Canada Car Co.'s plant at Lachine has been completed so far as the exterior is concerned. Machinery is rapidly being installed, and it is expected that the operation of the plant will begin in September.

Cement from the new cement works at Sydney is being used in the construction of the post office at Antigonish, N.S. It is much whiter in appearance than the ordinary cement, sets very quickly, but does not get so hard as the foreign cement.

The C. N. R. has let the contract for a $40,000 station at Port Arthur. Five new stations are also to be built between Rainy River and Port Arthur. It is said one of these new stations will be built at LaValle and the other four east of Atikokan.

Elliott, Woodard & Logue, Phoenix, B.C., have been awarded the contract for the clearing of the balance of the right of way for the high tension pole line of the West Kootenay Power & Light Co., for their extension from Bonnington Falls into the Boundary.

The building statistics for the first seven months of this year in Toronto, as compared with the same period last year, show as follows :

	1904.	1905.
Value	$3,470,433	$5,651,624
Value for July	844,550	1,157,298

Galt is to have a new industry which will be known as the Power and Gas Machine Co., and will be capitalized at $100,000. The factory, which will be 40x80 feet, will be erected at once, and cement blocks will be used in the building.

The value of buildings for which permits were issued in Vancouver during the month of July is greater by $57,700 than the value for June. Permits issued during July totaled in value $189,200, while the total for the month of June was only $131,500.

The Thorold Board of Trade is negotiating for the establishment of a factory there, to manufacture pulp containers, bottles of that material as well as other articles. An expenditure of $10,000 is probable if the deal goes through.

The Victoria, B. C., Machinery Depot have in hand the construction of a Cyclone water-tube boiler, 300 horse-power, working up to a pressure of 300 pounds, for furnishing heat to the retorts of the new turpentine works in that city.

W. N. Danley, owner of the Shawville (Que.) Mrble Works, thinks that there is sufficient excellent granite and marble in the district of Shawville to warrant an important quarrying industry being established there. All that is necessary is the capital.

Ottawa now owns the plant of the Consumers' Electric Light Co. and will operate it under the title of the City of Ottawa Electric Co. City bonds to the par value of $200,000 have been handed over to the Consumers' Co. for the deed to the property.

McKenzie & Mann and other owners of iron mines near Atikokan, have transferred their properties to the new Port Arthur Mines Co., Limited, capitalized at $500,000. Sulphur ore to the amount of 50,000 tons is to be shipped annually to the United States.

In consequence of enquiries received from the United States by the Goold, Shapely & Muir Co., Brantford, Ont., for their new continuous concrete mixer, a company has been formed in Buffalo with a capital of $75,000, to make the mixer on the American side.

The manufacturing of cement by the Sydney Cement Company began on July 10th. This is the first cement (Portland) to be manufactured east of Montreal in Canada. The new plant has a capacity for five hundred barrels per day of twenty- four hours.

The Merchants Bank will open up a branch at Napinka, Man., about the first of August. The citizens and farmers of that district have decided to erect a $5,000 building, the lower storey of which will be used by the bank, and the upper storey as a town hall.

Messrs. Alloway & Champion, Winnipeg, are erecting a two-storey bank building near the new C.P.R. depot, Winnipeg. The ground floor will be used for the purpose of the firm's banking business, while the second storey is being fitted up for general offices.

Owing to a scarcity of wheat at Fort William a broker who had a contract to deliver a certain amount in July found it necessary to re-ship 110,000 bushels back from Kingston by boat, this being the first wheat cargo ever passing westward through the "Soo" Canal.

The Canadian Fairbanks Co., Limited, Montreal, have been awarded the contract for the power transmission appliances, including Fairbanks' wood split pulleys and universal giant hangers for the new factory of the Gananoque Bolt and Nut Works.

The Dominion Coal Co., according to a Halifax dispatch, is to re-open operations on the Emery seam of the reserve colliery which produced 800,000 tons last year, the largest of any single colliery in the world. The output will be increased to 1,000,000 tons per year.

The Montreal Suspender and Umbrella Co. have asked the town of Arnprior, Ont., for a factory building and exemption from taxation for ten years, in consideration of which the company will commence the manufacture of their goods and will employ a large number of hands.

A company, backed mostly by American capital, and with headquarters in Cleveland, Ohio, are looking for a local factory in which to manufacture a special line of brushes. It is likely that Brantford, Ont., will secure the factory, which will employ a large number of hands.

The double tracking of the I. C. R. necessitates the building of a new bridge over the Sackville River at Bedford, N.B., and construction is now well under way. The construction is being done by F. A. Ronnan & Co., St. John, and the steel part by the Dominion Bridge Works.

The new plant of the Dominion Iron & Steel Co., Wabana, Belle Isle, Nfld., has been completel. The output at Wabana for the month of July was the largest in the history of those mines, 75,000 tons of ore being mined and shipped for the month. This amount can now be doubled.

The Canadian Klondike Mining Co. are importing a piece of machinery weighing 27,000 lbs. to be used in their mammoth dredge, which will be operated at the mouth of Bear Creek. All the bridges on the road over which the big piece passes will require special bracing to withstand its weight.

The Canada Foundry Co., Limited, has recently closed a contract with the Western Fuel Co., of Nanaimo, for two seventy-two inch diameter by eighteen feet long a hundred and fifty horsepower horizontal tubular boilers, working pressure a hundred and twenty-five pounds per square inch.

Electric power will be furnished for the western part of New Brunswick by the large power plant now being built at Aroostook Falls, N.B. Amongst the towns to be served are Fort Fairfield, Presque Isle, Caribou, Limestone and Houlton in Maine, and Andover and Perth in New Brunswick.

The Allis-Chalmers-Bullock, Co., Limited, Montreal, have been awarded the contract for the electrical and hydraulic machinery for the city of Nelson power plant on the Kootenay River, B.C. The amount of the tender for the electrical machinery was $29,985, and $13,600 for the hydraulic.

The Lake Superior Consolidated Co. intend to erect a coke plant with a capacity sufficient to supply the 150,000 tons of coke now consumed annually. A great many orders of various kinds have been received, and the present daily output amounts to 500 tons of rails and 450 to 500 tons of pig iron. The total

output of rails since the mill was started eight months ago amounts to 100,000 tons.

M. A. Halliday, owner of the electric lighting plant supplying Chesley, Ont., with light, is constructing a concrete dam in place of the former one, which will raise the water of the river two feet higher than at present. Thus he will get the extra power required by the increased lighting demands.

John Hanbury, of Brandon, Man., has started up the largest planing mill in British Columbia at Elks, and will handle lumber from the saw mills along the Crow's Nest road. Mr. Hanbury will make a specialty of getting out material for ready-made houses for settlers in the Northwest.

A twelve thousand dollar building is to be erected at the corner of St. James and Fulford streets, Montreal, by Mr. George Lanouette. The building is to be three stories in height, 60 feet square of brick and stone. The first floors will be occupied as stores and the upper flats will be used as dwellings.

Messrs. McDuff & Lemieux, architects, Montreal, are preparing plans for the erection of a new factory building which is to be situated on the south side of St. Antoine street near Windsor street of the same city. The new building will be five storeys high and will have a frontage of seventy-five feet.

The Robb Engineering Co. have secured orders for one 150-horse-power boiler for the Good Shepherd Asylum, Quebec; and 80-horse-power engine and boiler for the Electric Light Co., of Golden, B.C., and a 50-horse-power engine from Ahearn & Soper, Limited, for the Dunlap Tire Co., Toronto.

Zinc is selling at about 7¼ cents by the cask. Spetter is approximately the same. Horseshoe nails and horse shoes are in fair demand. Of the former, No. 8, countersunk, are about $8.75 per hundred weight; No. 7 being $9.60. Bar iron is firm, showing no change; galvanized iron is in good demand.

The Municipal Water and Light Company, Limited., have their steam ditcher at work at Pincher Creek, and the laying of the water mains will begin immediately. When the system has been installed the town will be provided with as good water and as efficient fire protection as any town in the west.

The Edmonton papers have advertisements calling for tenders for the erection and completion of a brick and stone station building to be erected at Edmonton for the Canadian Northern Railway Co. Also tenders for a ten stall engine house at Edmonton and frame station building at Fort Saskatchewan.

Montreal and New York capitalists have organized a hundred thousand dollar company to erect a magnificent new Summer hotel on Lake St. Louis, to be ready for business next season. The hotel will be close to Bellevue Station, on the New York Central, about thirty-five minutes' ride from Montreal.

The first annual report of the Lake Superior Corporation (the Soo industries) is a very satisfactory one, but this result has been achieved largely on account of the very favorable conditions under which the subsidiary companies have been working. A good deal has yet to be accomplished at the Soo.

The town of Galt has at last agreed to permit the Grand Valley Railway Co. to lay rails on the streets of the town and thus to connect with the G.H. & P. Railway. Up to the present time the Grand Valley have been running their cars to the corporation limits, and connecting with the G. H. & P. by 'bus.

At the annual meeting of the New Brunswick Telephone Co., it was decided to erect a number of lines during the present season. A brick building will be erected on Carleton street, Fredericton, for the use of the company's head offices, and the Moncton and Fredericton plants will be improved.

Reid Bros., machinists, who started in business in Regina about a year ago, with a staff of two men, have now a pay list of over fifteen hands. They are working overtime on their contracts for caps for the city sewerage system, and turning out some very heavy castings. Their building has been recently doubled in size.

Building permits issued in Winnipeg up to the first week in August aggregate $8,125,000. This is considerably in excess of the amount at the same time last year. It was not until October, in 1904, that the permits passed the $8,000,000 mark although the C.P.R. terminals and other unusual works were included.

The Tariff Committee of the Canadian Manufacturers' Association complains that the anti-dumping clause of the tariff is evaded by German and French manufacturers shipping through Great Britain. The committee wants more rigid inspectorship by Canadian officials and additional legislation if necessary to put a stop to this.

The Pedlar People, Oshawa, have of late been adding considerably to their already extensive plant, with the result that their manufactory now occupies a complete block of territory. The latest machinery is being installed in the new additions, conspicuous among which is a special scale-removing machine, to be used in connection with metal lath.

The C.P.R. are to erect twelve new stations on its new Guelph and Goderich iln. At Guelph and Goderich fine new stations will be built at a cost of from $35,000 to $45,000 each. At Elmira, Blythe and Milverton the stations will cost $8,000, and Monkton, Millbank, Weisenburg, Wellington, Linwood, Walton and Auburn will get $6,000 depots.

The wonderful development during the past few weeks of the mining discoveries near Cobalt on the Temiskaming Railway is the talk of the country. Already over $2,000,000 worth of ore has been raised and shipped to foreign smelters, and it is now proposed to establish a smelter in Ontario at North Bay, Sudbury or Toronto, to refine the silver ore.

All the buildings of the Montreal Light, Heat and Power Co. are to be absolutely fireproof. In the immediate future the work of rendering the big Chamhly power station absolutely fireproof will be started, after which the company intend to drop all the insurance they are carrying on their buildings. A saving of $10,000 a year will thus be effected.

Neepawa, Man., is considering a project to secure water-power from the White Mud River. The chief points are: It will cost $40,000, exclusive of the land covered, which will be 120 acres. The pent-up waters will aggregate 200,000,000 gallons, and with a fall of seventeen feet will produce 100 horse-power ten hours each day, for eight months of the year.

The Lehigh Portland Cement Co., of Allentown, Pa., have closed for the purchase of some 10,000 acres of limestone and clay lands lying east of the Belleville Portland cement plant, and will commence shortly to make clearings and erect storehouses, machine shops and dwellings, preparatory to erecting a plant next spring of 4,000 barrels per day capacity.

The Temiskaming Railway Commission has put a staff of prospectors on the town site of Cobalt, the title to which has been vested in it by the Ontario Government. As the site covers quite a large area right in the heart of the ore-bearing territory, it is quite likely that rich finds will be made, and the province's assets considerably increased thereby.

Building permits in Regina for the current year have already reached a total of $355,241, and it is estimated that the million dollar mark will be passed by the end of the season. Among the buildings which will be shortly commenced are: Regina Brewery, $30,000; Bank of Montreal, $50,000; Post Office (estimated), $70,000; Cockshutt Plow warehouse, $12,000.

The Toronto Shipbuilding Co. are expected to ihave three new steamers ready for the Toronto harbor fleet by May 1, 1906. One is for the Niagara Navigation Co., and the other two for the Toronto Ferry Co. It has not yet been decided whether the two latter will be side-wheelers or screw steamers, but they will have a carrying capacity of about 2,000.

The Imperial Steel and Wire Co., Limited, Collingwood, intends to enlarge its plant during the present Summer, bringing its capacity up to 50 tons of wire per day. Work on the buildings for the additional plant has been commenced. The building will consist of a fence mill, 60 x 200 feet, two storeys; galvanizing building, 40 x 250 feet, and warehouse, 100 x 200 feet

The new thirty-drill air compressor at the St. Eugene, the big silver mine in East Kootenay, was set in motion a few days since. It is one of the largest pieces of mining machinery in East Kootenay. The new plant has a capacity of 3,000 feet of air per minute. It will furnish power for thirty machine drills, bringing the number of these machines used in the mine up to fifty.

The Nova Scotia Steel and Coal Co. have put in operation their new open-hearth steel plant. The operation, conducted under the direction of the officials, was successful. The second and third furnaces have also turned out their first cast. For the present the battery will be limited to these three furnaces, of 40 tons each, and a 50-ton mixer. Two additional furnaces are in contemplation.

The statement of the Chicago Pneumatic Tool Co. for the half year ending June 30, 1905, has just been issued and shows a satisfactory state of affairs. The profit available for dividends was $273,736.52, of which a balance of $151,160.86 was carried to surplus. The surplus account showed an amount carried

forward from 1904 of $254,030.82, making a total surplus carried forward of $376,898.17.

Messrs. Fleming, of the Phoenix Foundry, St. John, N.B., have been awarded the contract by the Department of Public Works, Ottawa, for the construction of two steel scows for the dredge Geo. McKenzie. These scows will be one hundred feet long, twenty-two feet wide and eight feet deep, and will have a carrying capacity of two hundred cubic yards. They will be the first steel scows built in St. John.

Railway development of Southwestern British Columbia is progressing rapidly. The Nicola, Kamloops and Similkameen and the Midway and Vernon railways are now under construction. Midway seems to be a coming place. President Hill is operating from there on the construction of the V., V. & E., and the British Columbia Copper Co. have made arrangements for the construction of a large smelter there.

The largest economizer in the New England States has just been installed by the B. F. Sturtevant Co., Boston, Mass., for the American Woolen Co., at Maynard, Mass. It is divided into two groups, the first being used for heating feed water for the boilers and the second for furnishing hot water for dyeing purposes. Even before the installation was entirely completed a saving of $500 per day in coal was attained.

The season's building at Winnipeg is steadily creeping towards the eight million dollar mark. Up to date 2,050 permits have been issued, and the aggregate cost represented totals about $7,700,000. If things keep on at the present rate the $10,000,000 mark will be reached before the end of the building season. This year there are few very extensive buildings, and the permits for the most part cover residences and blocks.

The Nicola Valley Iron & Coal Co. will start active operations on their property in the Fall, and be ready to load on the first cars that come through on the Spence's Bridge in about a year from now. So says S. Tingley, of Ashcroft, who is heavily interested in the field. Mr. Tingley staked this field 28 years ago and has hung on ever since waiting for a road. He has great hopes of the future of the property.

Messrs. Hardenburg & Gilbert, architects, of New York, who are preparing the plans for the new Windsor Hotel in Montreal, have submitted the plans to the directors. The new hotel when finished will be 130 feet in height. Work will be begun about the first of September and it is expected when the Winter sets in that not only will the entire foundation be laid, but a fair amount of the steel structure will be placed.

The Canadian Pacific Railway management have practically decided to double track their line between Winnipeg and Fort William. This decision on the part of the company means the expenditure of $10,000,000. The company will do most of the work, very little of it being given to contractors. It will take three years and the distance covered will be 429 miles. This will be a great advantage in handling the Northwest crop.

Mr. C. D. Warren, president of the Lake Superior Corporation, speaks very hopefully of the condition of affairs in the district. Steel rails are being made at the rate of more than 500 tons a day, 1,000 tons of wood pulp are manufactured daily, and more than 4,000 men are employed. Contracts for steel rails are booked as far forward as next January, the amount being 75,000 tons, sufficient to construct 1,200 miles of railway.

The development of the LeTete copper mine at LeTete, N.B., continues to show very promising conditions. At the 200 foot level porphyry took the place of quartz, and a level driven 155 feet at that point has both hanging and foot walls of the former rock. It may be mentioned that porphyry is the gangue rock of many of the large copper mines of the United States. The LeTete ore is rich and easy smelting.

The contract for the hydraulic and electrical machinery for the city of Nelson power plant on the Kootenay River has been awarded to Allis-Chalmers-Bullock, Limited, Montreal. The tenders were: Canadian General Electric Co., $32,000 for the electrical machinery; the Canadian Westinghouse Co., $31,376 for the electrical machinery, and Allis-Chalmers-Bullock, Limited, $29,985 for the electrical and $13,600 for the hydraulic machinery. The latter company having tendered for both the hydraulic and electrical machinery had an advantage over the other two and were awarded the contract.

Fetherstonhaugh & Co., Canada Life Building, Montreal, report the following list of patents granted to Canadians: No. 94064, L. H. Bacque, Three Rivers, gas burners; No. 94068, H. Donkin, Glace Bay, N.S., rail joints; No. 94084, G. Valiant, Toronto, ventilated boots and shoes; No. 94085, G. Wardle, Tillsonburg, Ont., barn construction; No. 94097, D. W. Troy, N.Y., method of selecting electrical impulses; No. 94124, T. Fox, Woodbridge, Ont., antifriction bearings; No. 94152, J. H. K. McCollum, Toronto, electric controlling devices for cars; No. 94161, H. E. McLean, Toronto, governors for engines.

Many inquiries have been received from foreign firms who wish to purchase Canadian ores direct, especially zinc, chrome, nickel, cobalt, asbestos, mica, phosphate, coal and corundum. Among them are the following: Messrs. Armand & Co., Paris, are willing to purchase copper; M. De Rosenorn, Bordeaux, would like to buy Canadian phosphate; Edmond Gersenberger, Liege, would be willing to purchase ferro-silicon containing 35 per cent. of silicon; F. Pradez, Liege, would like to buy direct zinc and lead ores; Leon Deugmond, Brussels, inquiring about mica deposits; D. Carnegie, Hadfield Steel Foundry Co., Sheffield, for corundum.

CONTENTS.

MACHINERY BUYERS' DIRECTORY.

Readers of Canadian Machinery are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principa firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

Abrasive Materials.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Air Brakes.
Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Air Receivers.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Arbor Presses
Niles-Bement-Pond Co., New York.

Augers.
Chicago Pneumatic Tool Co., Chicago.

Axle Cutter.
A. B. Jardine & Co., Hespeler, Ont.

Axle Setter and Straightener
A. B. Jardine & Co., Hespeler, Ont.

Babbit Metal.
Canada Metal Co., Toronto.

Barrels, Tumbling.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.
Niles-Bement-Pond Co., New York.

Batteries, Storage.
Chicago Pneumatic Tool Co, Chicago.

Bell Ringers.
Chicago Pneumatic Tool Co., Chicago.

Belting, Chain
Waterous Engine Works Co., Brantford.

Belting, Leather.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.
Williams & Wilson, Montreal.

Belting, Cotton.
Dominion Belting Co., Hamilton.
Sadler & Haworth, Montreal.

Belting Supplies.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.
Canada Machinery Co., Sarnia.
Chicago Pneumatic Tool Co., Chicago.
John Bertram & Sons Co., Dundas, Ont.
Niles-Bement-Pond Co., New York.

Benders, Tire.
Boynton & Plummer, Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.

Blowers.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass

Boilers.
Goldie & McCulloch Co., Galt.
Owen Sound Iron Works Co., Owen Sound
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Boiler Plates
R. Sullivan David, Montreal.

Boiler Compounds.
Canada Chemical Mfg. Co., London, Ont.

Bolt Cutters.
National Machinery Co., Tiffin, Ohio.

Bolt and Nut Machinery.
A. B. Jardine & Co., Hespeler, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Books, Mechanical.
Technical Pub. Co., Manchester.
The MacLean Pub. Co., Ltd., Toronto.

Boring and Drilling Machines.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Co. Sarnia.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.

Boring Machine, Upright.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.

Boring Machines, Wood.
Chicago Pneumatic Tool Co., Chicago.

Boring and Turning Mills.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Box Puller.
A. B. Jardine & Co., Hespeler, Ont.

Bulldozers.
John Bertram & Sons Co., Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Cabinets, Tool.
Armstrong Bros. Tool Co., Chicago.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
Rice Lewis & Son, Toronto.

Can Making Machinery
Canada Machinery Co., Sarnia.

Castings, Grey Iron.
Canada Machinery Co., Sarnia.
F. L. Hare, Oshawa, Ont.
The Owen Sound Iron Works Co., Owen Sound.

Castings, Brass.
F. L. Hare, Oshawa, Ont.
The Owen Sound Iron Works Co., Owen Sound.

Calipers.
L. S. Starrett & Co., Athol, Mass.
Rice Lewis & Son, Toronto.
Williams & Wilson, Montreal.

Centering Machines.
John Bertram & Sons Co., Dundas, Ont.
Pratt & Whitney Co., Hartford, Conn.

Centres, Planer.
Pratt & Whitney Co., Hartford, Conn.

Chemicals
Canada Chemical Co., London.

Chucks, Ring Grinding.
A. B. Jardine & Co., Hespeler, Ont.
Chicago Pneumatic Tool Co., Chicago.

Chucks, Drill and Lathe.
John Bertram & Sons Co., Dundas, Ont.
Ker & Goodwin, Brantford.
King & Crosby Hamilton.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Chucks, Drill
Jacob's Mfg. Co., Hartford, Conn.

Chucks, Planer.
Francis Reed Co., Worcester, Mass.

Chucking Machines.
American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Potter & Johnston Mach. Co., Pawtucket, R.I.

Circuit Breakers.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Clippers, Bolt.
A. B. Jardine & Co., Hespeler, Ont.

Compressors, Air.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Condensers
Smart-Turner-Machine Co., Hamilton.

Consulting Engineers.
Canadian White Co., Montreal.
Charles Brandeis, Montreal.
John S. Fielding, Toronto.
Roderick J. Parke, Toronto.
T. Pringle & Son, Montreal.

Contractors.
Canadian White Co., Montreal.

Controllers and Starters, Electric Motor.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock Co., Montreal.

Conveyor Machinery
Waterous Engine Works Co, Brantford.
Williams & Wilson, Montreal.

Coping Machines.
John Bertram & Sons Co., Dundas, Ont.

Cranes
Niles-Bement-Pond Co., New York.
Smart-Turner-Machine Co., Hamilton.

Crank Pin Turning Machines
Niles-Bement-Pond Co., New York.

Cotton Belting.
Sadler & Haworth, Montreal.

Cupola Blowers.
Sheldon & Sheldon, Galt, Ont.

Cut Meters
The Canadian Fairbanks Co., Montreal.

Cutters, Flue.
Chicago Pneumatic Tool Co., Chicago.

Cutters, Milling.
Becker, Brainard Milling Machine Co. Hyde Park, Mass.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Machines.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.
Hurlbut-Rogers Machine Co., South Sudbury, Mass.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Tools.
Armstrong Bros. Tool Co., Chicago.
H. W. Petrie, Toronto.
Mechanics' Supply Co., Quebec.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Dies, Opening.
W. H. Banfield & Sons, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.
W. H. Banfield & Sons Toronto.
Canada Machinery Co., Sarnia.
The Globe Machine and Stamping Co. Cleveland, Ohio.

Dies, Threading.
W. H. Banfield & Sons Toronto.
Pratt & Whitney Co., Hartford, Conn.

Draft, Mechanical
B. F. Sturtevant Co., Hyde Park, Man.

Drawing Instruments.
Mechanics' Supply Co., Quebec.

Drawn Steel, Cold.
Canadian Drawn Steel Co., Hamilton.

Drilling Machines, Arch Bar
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.

Drilling Machines, Boiler.
American Tool Works Co., Cincinnati.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
Canada Machinery Co, Sarnia.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Connecting Rod.
John Bertram & Sons Co., Duudas, On .

Drilling Machines, Locomotive Frame.
John Bertram & Sons Co., Dundas, Ont.

Drilling Machines, Multiple Spindle.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill & Tool Co., Cincinnati.
Canada Machinery Agency, Montreal.
Canada Machinery Co., Sarnia.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Pneumatic.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drilling Machines, Portable.
A. B. Jardine & Co., Hespeler, Ont.

Drilling Machines, Radial.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Bickford Tool & Drill Co., Cincinnati.
Canada Machinery Agency, Montreal.
Canada Machinery Co., Sarnia
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Suspension.
John Bertram & Sons Co., Dundas, Ont.

Drilling Machines, Turrett
Canada Machinery Co., Sarnia
Niles-Bement-Pond Co., New York.

Drilling Machines, Upright.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co. Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
Canada Machinery Co., Sarnia.
The Canadian Fairbanks Co., Montreal.
Krug & Crosby, Hamilton.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson Montreal.

Drills, Bench.
B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
King & Crosby, Hamilton.
London Machine Tool Co., London.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.
Francis Reed Co., Worcester, Mass.

Drills, Blacksmith.
Francis Reed Co., Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Centre.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn
L. S. Starrett Co., Athol, Mass.

Drills, Chucks.
A. B. Jardine & Co., Hespeler, Ont

Drills, Clamp.
Francis Reed Co., Worcester, Mass.

Drills Electric.
Chicago Pneumatic Tool Co., Chicago.

Drills, Hand.
A. B. Jardine & Co., Hespeler, Ont.

Drills, High Speed.
Wm. Abbott, Montreal.
Pratt & Whitney Co., Hartford, Conn.

Drills, Horizontal.
B. F. Barnes Co., Rockford, Ill
John Bertram & Sons Co., Dundas, Ont.

Construction on the Nelson, B.C., electric power and light plant, to cost between $150,000 and $200,000, is to be commenced immediately. The contract for the hydraulic and electrical equipment has been awarded to the Allis-Chalmers-Bullock Co., of Chicago, through the Vancouver agency. This contract alone calls for an expenditure of $55,000. The contract for the hydraulic and electric equipment embraces two vertical turbine waterwheels, and one 750-kilowatt generator with a complete complement of transformers and sub-station equipment.

For the benefit of readers is published a list of Canadian patents recently secured through the agency of Messrs. Marion & Marion, patent attorneys, Montreal, Canada, and Washington, D.C. Information relating to any of the patents cited will be supplied free of charge by applying to the above-named firm: No. 94067, John Crozier, Ste. Agathe (Lotbiniere), Que., railway rail chair; 94323, Casimir Daudelin, Montreal, Que., apparatus for use in cleaning buildings; 94358, George S. Cushing, St. John, N.B., process of making wood pulp; 94373, Henry Schippling, Tavistock, Ont., dumping wagon; 94384, Messrs. Brown & McKie, Grand Forks, B.C., slag bowl; 94414, Robert M. Beal, Lindsay, Ont., process of manufacturing moccasins; 94421, Herman W. Dorken, Montreal, Que., skate; 94242, Ernest J. Jarman, Lachine Locks, Que., saw; 94441, Joseph Metivier, St. Roch de Quebec, P.Q., improvements in boots; 94462, James J. Timmons, Quebec, P.Q., beverages.

Canada Machinery Agency, Montreal.
Canada Machinery Co., Sarnia.

Drills, Pneumatic.
Chicago Pneumatic Tool Co , Chicago.

Drill, Radial
Canada Machinery Co., Sarnia.
London Machine Tool Co., London.

Drills, Ratchet.
A. B. Jardine & Co., Hespeler, Ont.
Mechanics' Supply Co , Quebec.
Pratt & Whitney Co., Hartford, Conn.
Armstrong Bros. Tool Co . Chicago.

Drills, Rock.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.
Francis Reed Co., Worcester, Mass.

Drills, Shop View.
John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.
Chicago Pneumatic Tool Co , Chicago.
A. B. Jardine & Co., Hespeler, Ont.
New Process Twist Drill Co. Taunton, Mass.

Drop Forging Dies.
The Globe Machine and Stamping Co Cleveland, Ohio.

Drying Apparatus of all Kinds.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dump Cars
The Owen Sound Iron Works Co Owen Sound.

Dust Separators.
Sheldon & Sheldon, Galt, Ont.

Dynamos.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London,Ont.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
United Electric Co., Toronto.
Volta Electric Repair Works, Toronto.

Economizer, Fuel
B. F. Sturtevant Co., Hyde Park, Man.

Electrical Supplies.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London,Ont.
Packard Electric Co., St. Catharines.
The United Electric Co., Toronto.
Volta Electric Repair Works, Toronto.

Electrically-Driven Tools and Machinery.
Allis-Chalmers Bullock, Montreal.
American Tool Works Co., Cincinnati.
Canada Machinery Agency, Montreal.
Canada Machinery Co., Sarnia.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Electrical Repairs.
Volta Electric Repair Works, Toronto.

Emery Wheel Dressers.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.

Engineers and Contractors
Canadian White Co., Montreal.
Electrical Construction Co., London.

Engineers' Supplies.
Mechanics' Supply Co., Quebec
Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Engines, Steam.
Allis-Chalmers-Bullock, Montreal.
The Goldie & McCulloch Co., Galt, Ont.
E. Leonard & Sons, London.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.
The Owen Sound Iron Works Co., Owen Sound.
Waterous Engine Works Co., Brantford.

Exhaust Heads.
Sheldon & Sheldon, Galt, Ont.

Expanded Metal.
Expanded Metal and Fireproofing Co., Toronto

Expanders.
A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Feed Mills.
S. Vessot & Co., Toronto.

Files.
Mechanics' Supply Co., Quebec.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.

Fire Apparatus
Waterous Engine Works Co., Brantford.

Fish Plates
R. Sullivan David, Montreal.

Flour Mill Machinery
The Goldie & McCulloch Co., Galt, Ont.

Flue Rollers.
Chicago Pneumatic Tool Co., Chicago.

Forges.
Allis-Chalmers-Bullock, Montreal.
Boynton & Plummer, Worcester, Mass.
Mechanics' Supply Co., Quebec.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Forgings, Drop
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.

Forging Machinery.
National Machinery Co., Tiffin, Ohio

Friction Clutch Pulleys, etc.
The Goldie & McCulloch Co., Galt, Ont.

Gang Drills.
B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co New York.

Gas Blowers and Exhausters
B. F. Sturtevant Co., Hyde Park, Man.

Gas Plants, Suction
Wayland, Williams & Padson, Montreal.

Gauges, Standard.
Pratt & Whitney Co., Hartford, Conn.

Gear Cutting Machinery.
Becker - Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati.
Canada Machinery Agency Montreal.
Canada Machinery Co., Sarnia.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co , Hartford, Conn.
Williams & Wilson, Montreal.

Gears, Angle.
Chicago Pneumatic Tool Co., Chicago.

Gears, Reducing.
Chicago Pneumatic Tool Co., Chicago.

Generators.
Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
The United Electric Co., Toronto.

Grinders, Centre.
Canada Machinery Co., Sarnia.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Cincinnati Milling Mach. Co., Cincinnati.
Pratt & Whitney Co., Hartford, Conn.

Grinders, Tool.
Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
Canada Machinery Agency, Montreal.

H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Grinding and Polishing Machines.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Hack Saws
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
West Haven Mfg. Co., New Haven,Conn.
Williams & Wilson, Montreal.

Hammers, Drop
London Machine Tool Co., London.

Hammers, Pneumatic.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co , Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Hammers, Steam.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.

Hangers
The Goldie & McCulloch Co., Galt, Ont.

Heating Apparatus.
Sheldon & Sheldon, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., High Park, Mass.

Hoisting and Conveying Machinery.
Allis-Chalmers-Bullock, Montreal.
Niles-Bement-Pond Co., New York.
The Smart- Turner Mach. Co., Hamilton.

Hoists, Pneumatic.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Hose, Air.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co. Chicago.

Hose, Couplings.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co. Chicago.

Hose, Steam
Canadian Rand Drill Co., Montreal.

Indicators, Speed
T. S. Starrett Co., Athol, Mass

Injectors.
Canada Foundry Co., Toronto.
The Canadian Fairbanks Co., Montreal.
Penberthy Injector Co., Windsor Ont.
Rice Lewis & Son. Toronto.

Iron Tools.
Canada Machinery Co., Sarnia.
Mechanics' Supply Co., Quebec.
H. W. Petrie, Toronto.

Lace Leather.
Sadler & Haworth, Montreal.

Lamps, Arc and Incandescent
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Packard Electric Co , St.Catharines.
The United Electric Co., Toronto.

Lathe Dogs.
Armstrong Bros., Chicago.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.

Lathes.
American Tool Work Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co , Dundas, Ont
The Canadian Fairbanks Co., Montreal.
Canada Machinery Co., Sarnia
London Machine Tool Co., London.
R. McDougall & Co., Galt, Ont
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Sebastian Lathe Co., Cincinnati, O.

Lathes, Automatic, Screw-Threading.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.
Pratt & Whitney Co., Hartford, Conn

Lathes, Turret.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.
The Pratt & Whitney Co.,Hartford,Conn.

Leather Belt Dressing.
Sadler & Haworth, Montreal.

Leather Belting.
Sadler & Haworth, Montreal.

Leather Belting, Waterproofed.
Sadler & Haworth, Montreal.

Ledgers, Loose Leaf.
Rolla L. Crain Co., Ltd., Ottawa.

Locomotives, Air
Canadian Rand Drill Co., Montreal.

Locomotives, Steam
Canada Foundry Co., Toronto.
Canadian Rand Drill Co., Montreal

Lumber Dry Kilns.
H. W. Petrie. Toronto.
Sheldon & Sheldon Galt.

Machinery Dealers.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Machinery Exchange, Montreal.
Mechanics' Supply Co., Quebec.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Williams & Wilson Montreal.
C. C. Wormer Mach. Co., Windsor.

Machinists
W. H. Banfield & Sons, Toronto.
Wm. Butler, Hamilton.
F. E. Hare, Oshawa.
Kruz & Crosby, Hamilton.

Machinists' Small Tools.
Armstrong Bros., Chicago.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.
Rice Lewis & Son, Montreal.
L. S. Starrett Co., Athol, Mass.
Williams & Wilson, Montreal.

Mailing Weights.
A. B. Jardine & Co., Hespeler, Ont.

Mandrels
A. B. Jardine & Co., Hespeler, Ont.
The Pratt & Whitney Co., Hartford,Conn.

Measuring Machines
The Pratt & Whitney Co.,Hartford,Conn.

Mechanical Draft.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Metallic Lacing.
Sadler & Haworth, Montreal.

Mill Machinery
The Goldie & McCulloch Co., Galt, Ont
The Owen Sound Iron Works Co., Owen Sound.
H. W. Petrie, Toronto.
S. Vessot & Co., Toronto.
Williams & Wilson, Montreal.

Milling Attachments.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Hartford, Conn.

Milling Machines, Horizontal.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney, Hartford, Conn.

Milling Machines, Plain.
American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co. Hyde Park,Mass
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
Cincinnati Milling MachineCo.,Cincinnati
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Milling Machines, Universal.
American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont
Canada Machinery Agency, Montreal
Cincinnati Milling MachineCo.,Cincinnati
The Canadian Fairbanks Co., Montreal
Niles-Bement Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Milling Machines, Vertical.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
John Bertram & Sons Co , Dundas, Ont
Niles-Bement Pond Co., New York.

Milling Tools.
Wm. Abbott, Montreal.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.

Mining Machinery.
Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pnematic Tool Co., Chicago.
Jenckes Machine Co., Sherbrooke, Que.

Model Tools.
Mechanics' Supply Co., Quebec.
Wells Pattern and Model Works, Toronto

Motors, Electric.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London.
The Packard Electric Co., St. Catharines.
B. F. Sturtevant Co., Hyde Park, Man.
The United Electric Co., Toronto.

Motors, Air.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Nippers, Stay Bolt.
Chicago Pneumatic Tool Co. Chicago.

Nut Tappers.
John Bertram & Sons Co., Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Oatmeal Mill Machinery.
The Goldie & McCulloch Co., Galt
S. Vessot & Co., Toronto.

Painting Machines, Pneumatic.
Chicago Pneumatic Tool Co, Chicago.

Patent Solicitors.
Hanbury A. Budden, Montreal.
Fetherstonhaugh & Co., Montreal.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

Patterns.
Wells' Pattern and Model Works, Toronto

Pipe Cutting and Threading Machines.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Oster Mfg. Co., Cleveland, O.

Planers, Standard.
American Tool Works, Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.
Cincinnati Planer Co., Cincinnati.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Planers, Rotary.
John Bertram & Sons Co., Dundas, Ont.
Niles-Bement Pond Co., New York.

Planing Mill Fans.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Plug Drillers, Pneumatic
Canadian Rand Drill Co, Montreal.

Pneumatic Tools.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Presses, Drop
Canada Machinery Co., Sarnia.

Presses, Hydraulic.
John Bertram & Sons Co., Dundas, Ont.
Niles-Bement-Pond Co., New York.

Presses, Power
Canada Machinery Co., Sarnia.
Niles-Bement-Pond Co., New York.

Pulleys.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Williams & Wilson, Montreal.

Pumps.
Allis-Chalmers-Bullock, Montreal.
Canada Foundry Co., Toronto
D'Olier Engineering Co., New York.
The Goldie & McCulloch Co., Galt.
The Owen Sound Iron Works Co., Owen Sound.

H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton

Pumping Machinery
Canada Machinery Agency, Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago

Punches and Dies.
W. H. Banfield & Sons, Toronto.
The Globe Machine and Stamping Co., Cleveland, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co, Hartford, Conn.
H. W. Petrie, Toronto.

Punches, Power.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co. Sarnia.
Niles-Bement-Pond Co.. New York.

Punches, Turret.
Taylor & McKenzie, Guelph.

Punching Machines, Horizontal.
John Bertram & Sons Co., Dundas, Ont

Quartering Machines.
John Bertram & Sons Co., Dundas, Ont.

Reamers.
Wm. Abbott, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Hartford, Conn.

Reamers, Steel Taper.
Chicago Pneumatic Tool Co., Chicago.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Hartford, Conn.

Rheostats
Canadian General Electric Co., Toronto.

Riveters, Hydraulic.
Niles-Bement-Pond Co., New York.

Riveters, Pneumatic.
Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co, Chicago.
Niles-Bement-Pond Co., New York.

Rolls, Bending.
John Bertram & Sons Co., Dundas, Ont
Canada Machinery Co, Sarnia.

Rubber Belting.
Sadler & Haworth, Montreal.

Safes
The Goldie & McCulloch Co., Galt, Ont.

Sand Blast Machinery.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Saw Gummer.
A. B. Jardine & Co., Hespeler, Ont.

Saw Mill Machinery.
Allis-Chalmers-Bullock, Montreal.
Clark-Demill Co., Hespeler, Ont.
Goldie & McCulloch Co., Galt.
Owen Sound Iron Works Co., Owen Sound
H. W. Petrie, Toronto.
Waterous Engine Works, Brantford.
Williams & Wilson, Montreal.

Sawing Machines, Metal.
Niles-Bement-Pond Co. New York.
West Haven Mfg. Co., New Haven, Conn.

Saws, Hack.
Mechanics' Supply Co, Quebec.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Second-hand Machinery.
Canada Machinery Agency, Toronto.
The Canadian Fairbanks Co., Montreal.
Goldie & McCulloch Co., Galt.
Machinery Exchange, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.
C. C. Wormer Mach. Co., Windsor.

Screw Machines, Automatic.
Pratt & Whitney Co., Hartford, Conn.

Screw Machines, Hand.
Potter & Johnston Mach. Co., Pawtucket, R.I.
Pratt & Whitney &o., Hartford, Conn.

Screw Plates.
Oster Mfg. Co., Cincinnati, O.

Shafting
Canadian Drawn Steel Co., Hamilton.
The Canadian Fairbanks Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.

Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
C. C. Wormer Machinery Co., Sarnia.

Shapers.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
Canada Machinery Co., Sarnia.
Cincinnati Shaper Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson Montreal.

Shearing Machine, Bar.

John Bertram & Sons Co., Dundas, Ont
Canada Machinery Co., Sarnia.

Shears, Power.

A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.

Sheet Metal Goods.

The Globe Machine and Stamping Co., Cleveland, Ohio.

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Canada Machinery Co., Sarnia.

Sleeves, Reducing.

Chicago Pneumatic Tool Co., Chicago.

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John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.
Niles-Bement-Pond Co., New York.

Slide Rests

Niles-Bement-Pond Co., New York.

Special Machinery.

W. H. Banfield & Sons, Toronto.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.
The Globe Machine and Stamping Co. Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart Turner Mach. Co., Hamilton.

Special Machines and Tools.

Pratt & Whitney, Hartford, Conn.

Special Manufacturing.

The Globe Machine and Stamping Co. Cleveland, Ohio.
F. E. Hare, Oshawa.

Speed Changing Countershafts.

The Canadian Fairbanks Co., Montreal

Spike Machines.

National Machinery Co., Tiffin, O.
The Smart-Turner Mach. Co., Hamilton.

Steam Separators.

Sheldon & Sheldon, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.

Steam Specialties

Engineering Specialties Co., Belfast, Ireland.

Steam Traps.

Engineering Specialties Co., Belfast, Ireland.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Stampings, Sheet Metal.

Globe Machine and Stamping Co., Cleveland, Ohio.

Stamps, Steel and Rubber

Superior Mfg. Co., Toronto.

Steel, High Speed.

Wm. Abbott, Montreal.
Canadian Fairbanks Co., Montreal.
B. K. Morton Co., Sheffield, Eng.

Steel Pressure Blowers.

Sheldon & Sheldon, Galt, Ont.

Stone Cutting Tools, Pneumatic

Canadian Rand Drill Co., Montreal.

Stone Surfacers.

Chicago Pneumatic Tool Co., Chicago.

Swage, Block.

A. B. Jardine & Co., Hespeler, Ont.

Switchboards

Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co. of Toronto.
The United Electric Co., Toronto.
Volta Electrical Repair Works, Toronto.

Tapes, Steel

Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Taps and Dies.

Wm. Abbott, Montreal.
The Geometric Tool Co., New Haven, Conn.
A. B. Jardine & Co., Hespeler, Ont.
Mechanics' Supply Co., Quebec.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Taps, Collapsing

The Geometric Tool Co., New Haven, Conn.

Tapping Machines and Attachments.

American Tool Works Co., Cincinnati.
Bickford Drill & Tool Co., Cincinnati.
The Geometric Tool Co., New Haven, Conn.

Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney, Cincinnati, O.
L. S. Starrett Co., Athol, Mass.
Williams & Wilson, Montreal.

Tiling, Opal Glass

Toronto Plate Glass Importing Co., Toronto.

Time-Recording Clocks.

Canadian Time Recording Co., Toronto

Tinplates.

R. Sullivan David, Montreal.

Tinware Machinery

Canada Machinery Co., Sarnia.

Tire, Upsetters or Shrinkers.

A. B. Jardine & Co., Hespeler, Ont.

Tool Cutting Machinery

Canadian Rand Drill Co., Montreal.

Tool Holders.

Armstrong Bros. Tool Co., Chicago.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Tool Steel.

Wm. Abbott, Montreel.
Canadian Fairbanks Co., Montreal
B. K. Morton & Co., Sheffield, Eng.
Williams & Wilson, Montral.

Transformers and Convertors

Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.

Transmission Machinery.

The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Transmission Supplies.

The Goldie & McCulloch Co., Galt.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.

Trolleys

Canadian Rand Drill Co., Montreal.

Tube Expanders (Rollers).

Chicago Pneumatic Tool Co., Chicago.

Turbines, Steam

Canadian General Electric Co., Toronto.
D'Olier Engineering Co., New York.

Turret Machines.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Twist Drills

See drills.

Upsetting and Bending Machinery.

National Machinery Co., Tiffin, O.

Valves, Back Pressure.

Sheldon & Sheldon, Galt.

Valves, Blow-off.

Chicago Pneumatic Tool Co., Chicago.

Valves, Reducing

Engineering Specialties, Belfast, Ireland.

Vaults.

The Goldie & McCulloch Co., Galt.

Ventilating Apparatus.

Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Vises, Planer and Shaper.

American Tool Works Co., Cincinnati, O.
Cincinnati Planer Co., Cincinnati.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.

Vises, Machinists.

Mechanics' Supply Co, Quebec.
Rice Lewis & Son, Toronto

Washer Machines.

National Machinery Co., Tiffin, Ohio.

Water Wheels

The Goldie & McCulloch Co., Galt, Ont.
The Jenckes Machine Co., Sherbrooke, Que.

Window Wire Guards.

B. Greening Wire Co., Hamilton, Ont.

Wire Chains.

The B. Greening Wire Co., Hamilton.

Wire Cloth and Perforated Metals.

B. Greening Wire Co., Hamilton. Ont.

Wire Guards and Railings.

B. Greening Wire Co., Hamilton, On

Wire Nail Machinery.

National Machinery Co., Tiffin, Ohio

Wire Rope.

B. Greening Wire Co., Hamilton, Ont.

Wood-working Machinery.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Clark-Demill Co., Hespeler, Ont.
Goldie & McCulloch Co., Galt.
Owen Sound Iron Works Co., Owen Sound
H. W. Petrie, Toronto.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Wrenches, Adjustable Tap.

A. B. Jardine & Co., Hespeler, Ont.

ALPHABETICAL INDEX.

The Owen Sound Iron Works Company, Limited

Engineers, Founders, Machinists and Boilermakers

OF OWEN SOUND, - ONTARIO

Manufacturers of Saw, Shingle and Lath Machinery.

Engines and Boilers and Tank Work.

Cement Mill Machinery, Duplex Slurry Pumps, Rotary Kiln Feed Pumps, Wash Mills, Agitators, Rotary Coolers, Rotary Coal Screens, Disintegrators and Dump Cars.

Special attention given to repair work and jobbing of all kinds. Castings in Grey Iron and Brass, any size or quantity.

MARINE WORK

SPECIAL ATTENTION IS PAID TO MARINE REPAIRS OF ALL KINDS TO ENGINES, BOILERS OR STEAM VESSELS.

"MADE IN CANADA."

SENTIMENT vs. BUSINESS

To expect a Canadian manufacturer to purchase a "Made in Canada" article, with nothing more than being Canadian made to recommend it, is appealing to SENTIMENT

but

To expect him to purchase a "Made in Canada" article, in every way equal to the imported article, in price, quality and efficiency, is BUSINESS.

MORAL — Specify "Imperial" on your next pnuematic tool order.

The Canadian Rand Drill Co.

Room 10, Imperial Bank Bldg.,

MONTREAL, Que.

"RAND AND RELIABILITY."

SELECTED THE FOLLOWING FROM OUR STOCK OF . . .

SECOND-HAND—FINE CONDITION

Engine Lathes

10″ x 4′ Sebastian Foot Power and c. s.
13″ x 6′ Pratt & Whitney, with taper, R & F rest.
14″ x 6′ Bogert, R. & F. rest.
14″ x 6′ Flather, R. & F. rest.
14″ x 6′ Reed, R. & F. rest.
17″ x 6′ Gray, Plain rest.
18″ x 6′ Jones & Lamson, R. & F. rest.
18″ x 6′ Perkins, R. & F. rest.
20″ x 10′ Bement Compound rest.
24″ x 12′ LeBlond Compound rest with chuck.
24″ x 14′ Lodge & Shipley Compound rest and taper.
24″ x 16′ Fifield Compound rest.
26″ x 22′ Pond Compound rest.
38″ x 16′ Fifield Compound rest with R. B. to swing 50″.
40″ x 21′ Fifisld Compound R. with 4 chuck jaws.

Special Lathes

20″ x 12′ Schumacker & B. Screw Cutting, compound rest, with turret on shears having power feed.
24″ x 14′ Reed Special Turning Lathe, two tool posts, oil pan, pump, etc.

Hammers

25 lb. Bradley Helve.
200 lb. Bement-Niles Steam.
450 lb. Bell Steam, regular type.
900 lb. Trethewey Steam.
50 lb. Beecher & Peck Poppet Drop.
1000 lb. Merrill Board Lift.
No. 2 Hawkeye belt driven.

Planers

22″ x 20″ x 5′ J. S. Wheelsr & Co.
30″ x 30″ x 8′ L. W. Pond M. T. Co.
42″ x 36″ x 11′ Wm. Sellers & Co.
72″ x 48″ x 20 Betts Machine T. Co.

Presses

No. 1 Cady Solid Back.
No. 2 Toledo Inclinable Open Back.
No. 3 Stiles Plain Solid Back.

Shapers

6″ Boynton & Plummer, Crank.
14″ John Steptos & Co., Crank.
24″ Walcott Geared.
24″ Hondey Pillar type friction driven.
24″ Gould & E. Double Triple Quick with E. Base.

Milling Machines

Back Geared Lincoln type with vise and c. s.
No. 3 Garvin overhanging arm, vise and vertical fixture.
No. 14 Kempsmith Plain with back gear and power vertical feed.
No. 2 Lodge & Davis Plain with back gear and 12″ Index Centers.

Drills

10″ Dwight Slate Bench.
36″ Snyder S. H. B. G. Q. & P. H.
5′ Arm Niles Semi-Universal Radial (Niles.)

Keyseaters

No. 1 10″ Giant, capacity up to 1¼″.
No. 2 13″ Giant, capacity up to 1½″.
No. 1 Davis, capacity up to 1″.

Pipe Machines

No. 1 Apex, capacity ½″ to 2″, R. & L., dies and nipple attach.
No. 1 Apex, capacity ½″ to 2″, R. H. dies.
No. 30 Curtis, ¼″ to 2″, R. L., Dies for hand power, side attach. mounted on stand.
No. 6½ Merrell, capacity 1″ to 6″, hand and power.

Screw Machines

⅜″ Cleveland Automatie.
⅝″ Cleveland Automatic.
No. 3 Warner & Swasey, Plain Head, wire feed.
14″ Garvin Friction Geared Head, auto. chuck.

Brass Workers' Machinery

No. 1 American Tool & Machine Co., Fox Turret.
No. 2 American Tool & Machine Co., Cabinet Turret Lathe.
No. 1 American Tool & Machine Co., Square Arbor Fox Lathe with Chasing Bar.
2-Spindle Bardons & Oliver Valve Milling Machine.
Cock Grinder, Warner & Swasey, on column.
Cock Grinder, Warner & Swasey, on legs.
9″ Windsor Plain Head Turret Lathe.
16″ x 3″ W. & S. Plain Head Turret Lathe

Speed Lathes

12″ Warner & Swasey, with slide rest.
15″ With set-over tail stock and two motions to spindle.
15″ Pryibil with slide rest.
11″ x 5′ with pan, set-over tail stock, double cut-off, turret tool fitted to tail stock.
9½″ Brown & Sharpe Polishing and Finishing Lathe.

Cutting-off Machines

2″ Pratt & Whitney Single Tool.
4″ Hurlburt & Rogers, accelerated speed with two tools.

Punches and Shears

No. 6 Long & Allstatter Single End, 4″ throat, cap. ½″ in ½″ with Shear blades.
No. 1 Bremer Single End, 5″ throat, cap. ⅜″ in ⅜″.
No. 2 Bremer Single End, 6″ throat, cap. ½″ in ½″, extra blades for angle iron and four punches.
No. 2 Bremer Blacksmith 7″ throat, cap. punching ½″ in ½″; shearing flat ½″ x 4″; round 1⅛″.
No. 3 Bremer Single End, 7″ throat, cap. ⅝″ in ⅝″, with shear blades.
No. 3 Bremer Ditto, with 24″ throat.
No. 1. Bremer Single Edd, 10″ throat, cap. ⅜″ in ⅜″, with shear blades.
No. 5 Bremer Double End, cap. 1″ in 1″, with shear blades, 12″ throat.
No. 3 Bremer Blacksmith, cap. punching ¾″ in ¾″, shear, flat ¾″ x 4″; round 1⅛″: 7½″ throat.
Heavy Alligator Shear, 12″ blades.
No. 2 Buffalo Hand Power, cap. ¼″ in ¼″, ¾″ round, 7 16″ x 2″ flat.

Wet Tool Grinders

No. 1 Diamond Bench.
Double End, Leland & Faulconer, wheels 24 x 1½.
Forming Tool Grinder, cup wheel 10 x 1½, Foote, Burt & Co.
12 x 1½, whesl on column with pump, Springfield Glue & Emery Wheel Co.
20″ x 3″, wheel on stand, Standard Machine Co Holyoke.
No. 2 Diamond on column, wheel 12 x 1½.
24 x 2″ wheel, W. F. & John Barnes.

Miscellaneous

36″ Swing Lathe for facing columns, with parallel 6″ higher, with flange and test hole drills.
44″ Dorner & Dutton Car Wheel Borer, with 36″ chuck.
200 Ton Horizontal Hydraulic Press, capacity 72″ x 12′ centres
9′ Wm. Sellors & Co., Boring and Turning Mill.
14″ Industrial Works Single Head Axle Laths, 8′ 4″ centres.
9″ Bement Slotter.
14′ 6″ Wm. Sellers & Co., Plate Planer.
3″ Woodward & Rogers Centering Machine.
No. 3½ Dayton Swaging Machine, ⅜″ capacity for tubing.
No. 4 Adams Double Head Bolt Cutter with dies ⅜″ to 1½″, self-opening heads.
⅜″ Adt. Automatic Straightening and Cutting-Off Machine, 16″ and shorter with countershaft.
Rotary Slotting Machine up to ¼″, series H-Garvin.
No. 1 Horizontal Tapping Machine up to 3 16, Garvin.
5 Ton Crane 14′ Mast.
8 Ton Chain Hoist.
Pulley, Drilling and Tapping Machine.
No. 4 Flexible Shaft with stop clutch and clamp die.
No 1 Root Horizontal Rotary Blower.
No. 11 64″ Buffalo Double Belted Pressure Blower.
60″ Sturtevant Engine Driven Steel Plate Fan, outlet 22½″, left hand up blast.
Iron Grind Stone Frame.
Large assortment polishing and buffing lathes on column and for bench.
Lot of planer jacks. Lot of cast iron bench legs.
National Oil Burning Furnace, with pump.

American Gas Furnaces

No. 3 Oil Tempering Furnace.
No. 4 Oven Furnace.
No. 1 Oven Furnace.
No. 16 Oven Furnace.
No. 31 Oil Tempering Furnace.
No 8 Large Crucible Furnace for tempering and lead bath.

All equipped with Gas Burners

Steam Engines

10 x 9 Westinghouse Jr., Automatic
8 x 7 Westinghouse Jr., Automatic.
9 and 15 x 9 Westinghouse Compound (two).
10 x 12 Atlas Centre Crank, Automatic.
12 x 30 Lane & Bodley Corlis L. H
16 x 32 Buckeye Automatic, right-hand.

Gas Engines

25 H. P. Westinghouse, upright.
54 H. P. Fairbanks, also for gasoline.

Heaters

75 H. P. No. 22 Cochrane, special.
250 H. P. 24 x 10′ closed type.

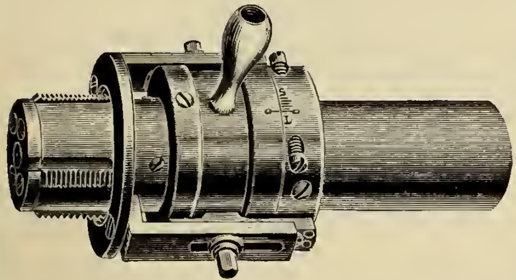
Pumps

8 x 6 x 10 Smith-Vale Duplex.
8 x 12 Gould Triplex Pump, Fig 17.
Worthington Vertical Duplex Double Acting Plunger type, with Eddy Motor, type G, 6 H. P. 220 volts speed 550.

We are ready at all times to purchase for cash high-grade second-hand machine tools. Prices and details of anything to offer solicited.

C. C. WORMER MACHINERY CO., *CORNER SANDWICH AND FERRY STREETS,* **WINDSOR, ONTARIO**

It Costs Something to Back Out.



EVERY time you back out a tap it costs money—not a lot of money—but enough to make a big difference in the cost of your tapping operations by the year.

There's no backing out when you use our

Adjustable Collapsing Taps

the chasers being collapsed at the end of the cut by means of the work coming in contact with an adjustable gauge on the tap, and the tap is then drawn back without touching the thread.

These time-saving taps are made in a good many sizes and styles, for use on screw machine turrets or for rotating on live spindles, and for tapping any kind of metal, either for pipe or straight threads of 1¼ in. or larger diameters.

They'll cut your tapping costs 50% if you're using solid taps.

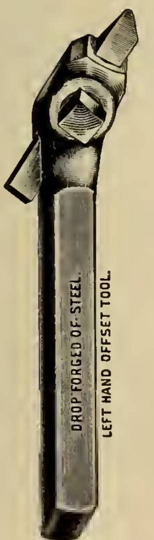
Tell us your requirements and we will send blue prints and quotations to cover same.

The Geometric Tool Co., - New Haven, Conn.

Canadian Agents: WILLIAMS & WILSON, Montreal, P.Q. **(Westville Station) U.S.A.**

IF YOU OWN STOCK

in a tool steel mill there may be some excuse for you continuing to forge lathe and planer tools. You may get some of the loss back in dividends.



ONE POUND OF TOOL STEEL USED IN AN ARMSTRONG TOOL HOLDER

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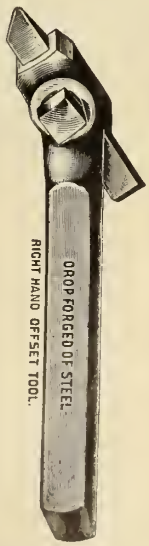

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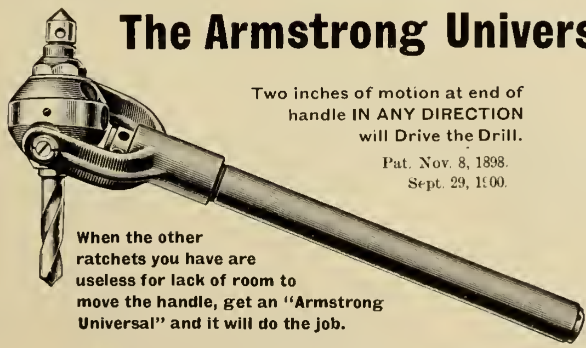

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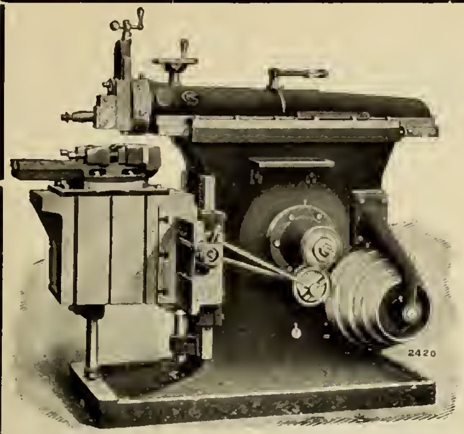

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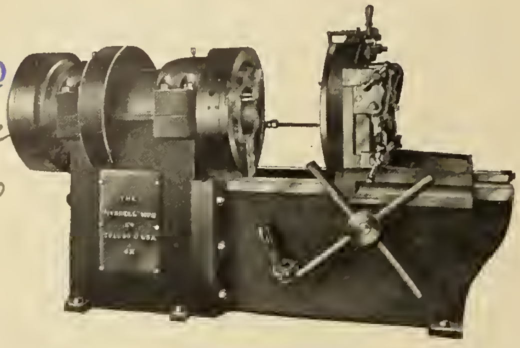

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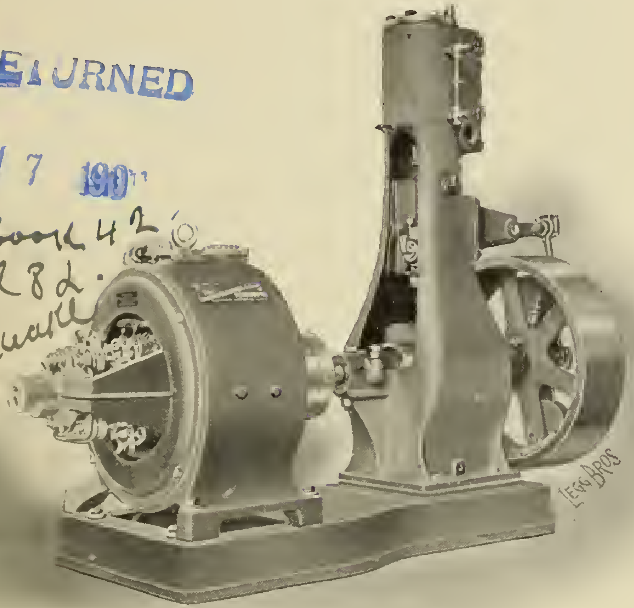

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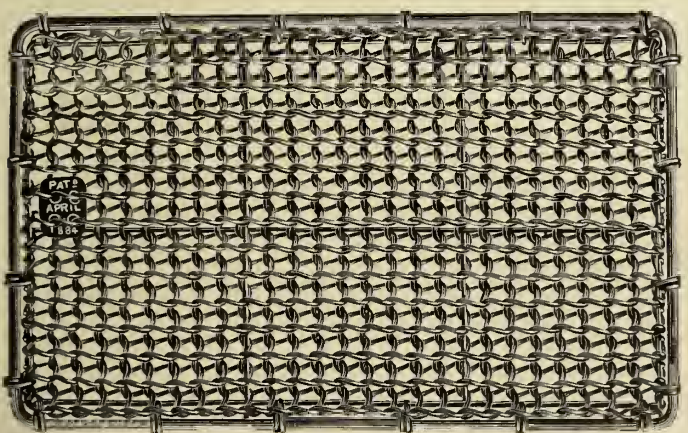

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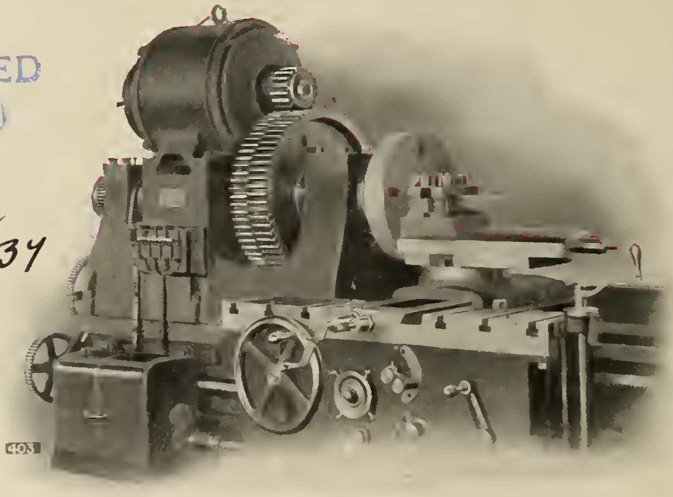

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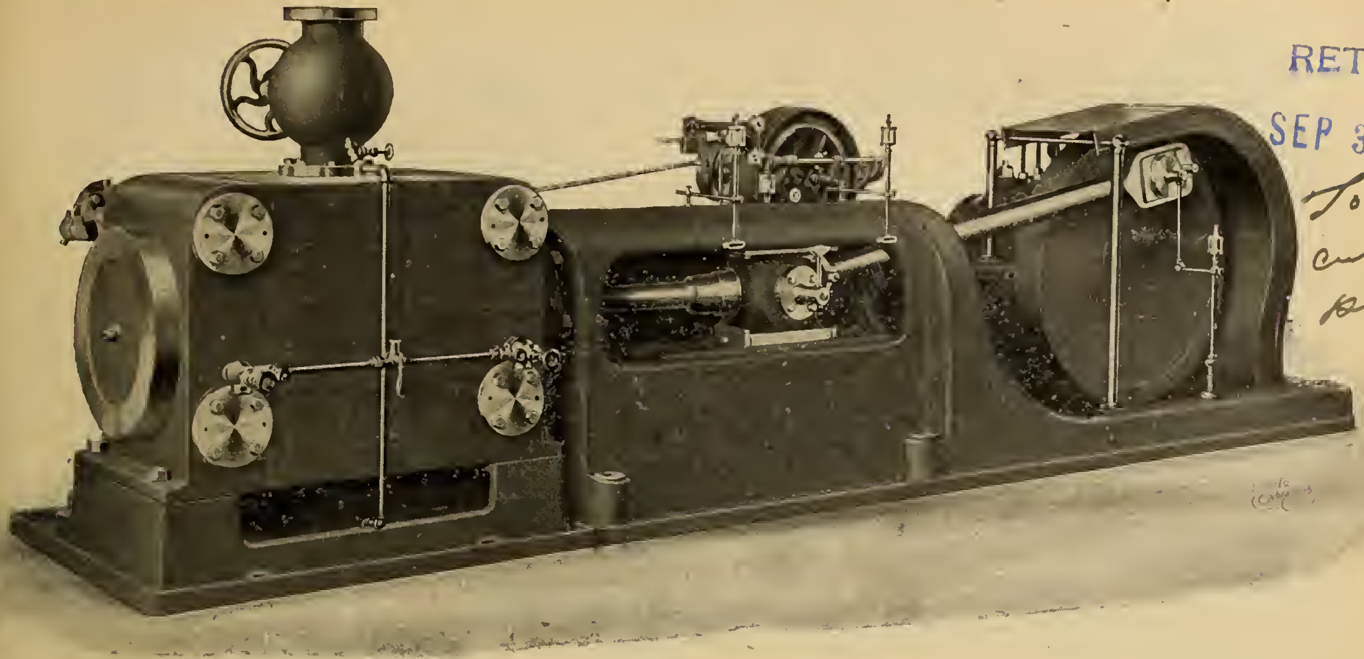

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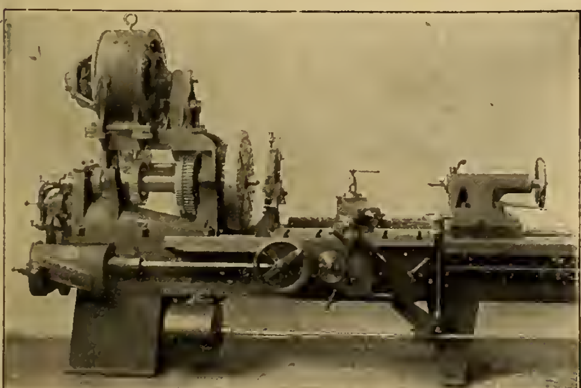

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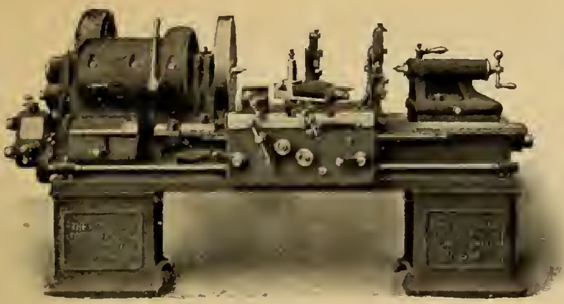

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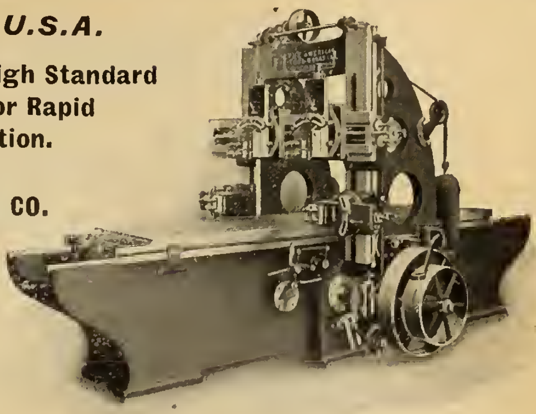

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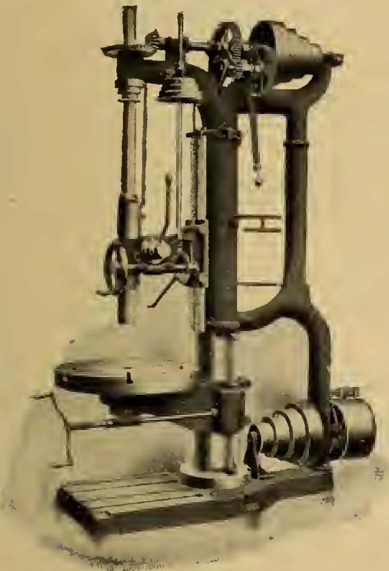

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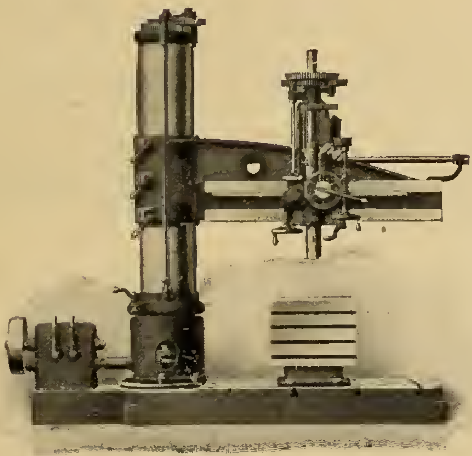

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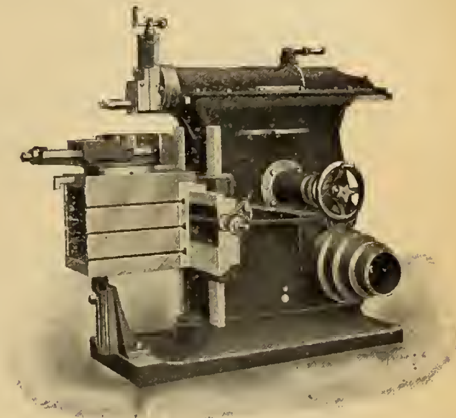

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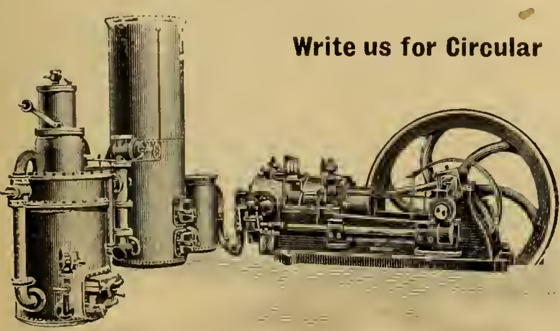

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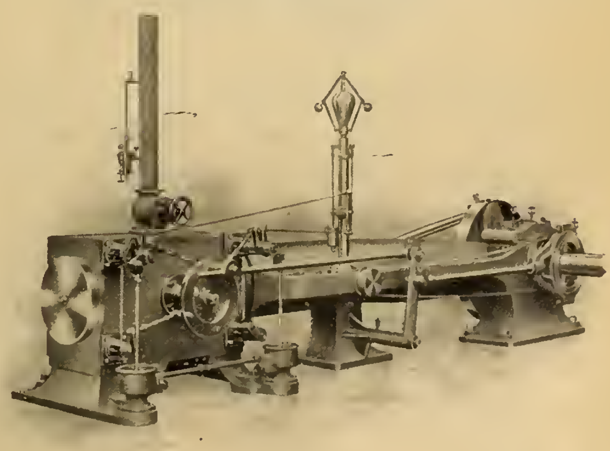

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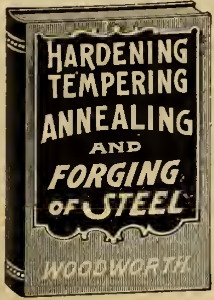

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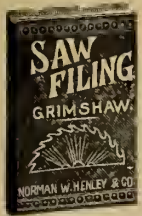

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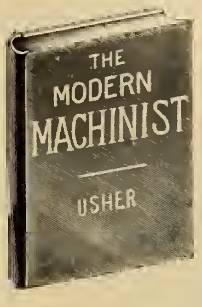

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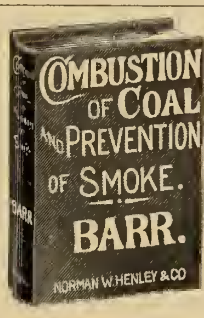

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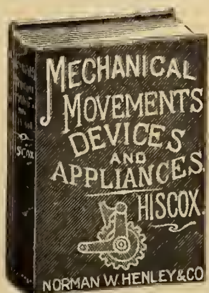

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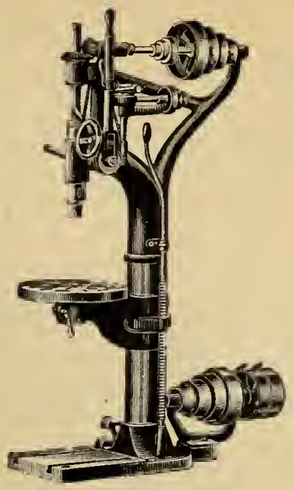

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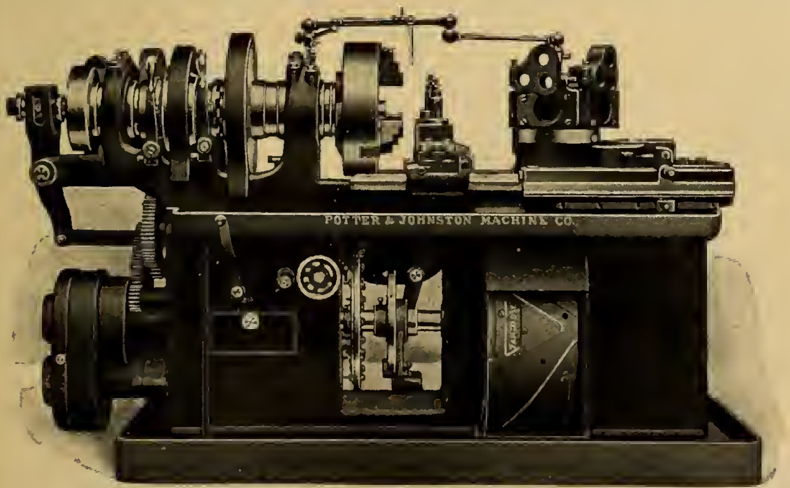

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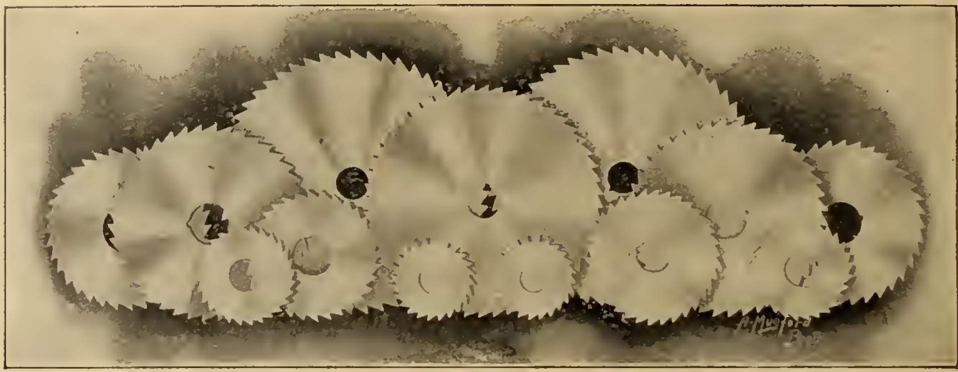

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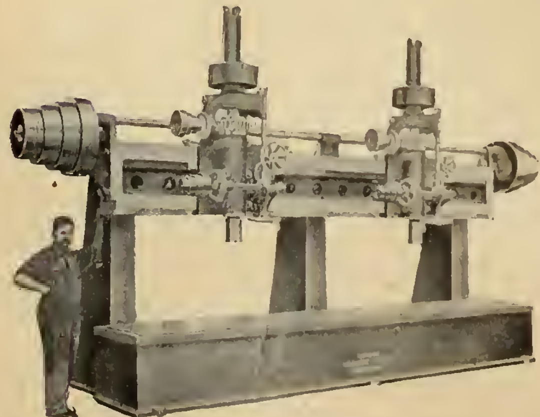

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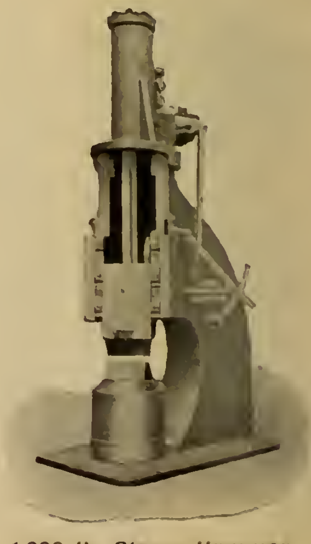

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60″ x 12′ " 82 3″ " NEW.
56″ x 12′ " 60 3″ "
48″ x 16′ " 33 4″ "
48″ x 13′ 6″ " 52 3″ "
48″ x 13′ 6″ " 42 3″ "
44″ x 13′ 6″ " 43 3″ "
44″ x 14′ 6″ " 40 3″ "
44″ x 11′ 9″ " 42 3″ "
40″ x 12′ " 2 13″ "
38″ x 12′ " 36 3″ "
32″ x 11′ " 22 3″ "

Upright Boilers

48″ x 10′ 6″ with 152 2″ tubes.
36″ x 84″ " 6 2½″ "
36″ x 72″ " 60 2″ "
30″ x 72″ " 42 2″ "
26″ x 60″ " 37 2″ "
26″ x 48″ " 3 2″ "
24″ x 5″ " 31 2″ "
20″ x 40″ " 41 2″ "
20″ x 36″ " 16 2″ " NEW.
19″ x 44″ " 13 2″ " NEW.
19″ x 40″ " 9 2″ " NEW.

Automatic Engines

24″ x 48″ Stearns Corliss.
17″ x 42″ Right Hand Brown.
16″ x 36″ NEW Laurie Corliss.
13″ x 30″ Left Hand Wheelock.
11″ x 24″ " " Corliss.
12″ x 10″ Westinghouss Junor.
12″ and 20″ x 12″ Eris Ball Tandem compound.
11″ and 19″ x 15″ McIntosh & Seymour Tandem compound.
11″ x 10″ Peerless, self-oiling.
11″ x 15″ NEW No. 9 Jewel.
10″ x 15″ " " 8 "
10″ x 12″ No. 7 Jewel
8″ x 10″ " 5 "
8″ and 13″ x 18″ Tandem compound.
6¾″ x 8″ Armington & Sims.
5″ x 7″ " "

Other Steam Engines

12″ x 12″ Laurie, NEW, horizontal.
11″ x 12″ " " "
10″ x 10″ Leonard C. C. "
9″ x 10″ " " "
8¾″ x 9″ horizontal.
8″ x 8″ Lauris, NEW, horizontal.
7″ x 12″ horizontal.
7½″ x 9″ Dutton, NEW, horizontal.
7″ x 7″ NEW, upright.
6″ x 9″ horizontal.
6″ x 7½″ " centre crank.
6″ x 8″ upright.
6″ x 6″ " NEW.
5″ x 6″ horizontal.
5″ x 7½″ upright, centre crank.
Also several small engines down to ¾ h.p., horizontal and upright.

Marine Engines

8″ and 16″ x 12″ NEW, fore and aft.
7″ and 14″ x 10″ " " "
7½″ and 14″ x 12″ steeple compound.
9″ x 12″ Doty.
9″ x 12″ NEW, complete.
7¾″ x 9″ NEW, Dutton.
7½″ x 8″ " "
6″ x 6″ all complete.
5″ x 7½″ " "
Also several smaller ones.

Miscellaneous Engines and Boilers

10 H. P. Westinghouse Traction.
48″ x 9″ Upright Sub. Tube Boiler.
30″ x 8′ " " "
36 H. P. Horizontal Self-Cont. Boiler.
8 H. P. " " "
25 H. P. Fire Box Boiler.
16 H. P. Waterous Portable Boiler.
7″ x 10″ Cornell " "
74″ x 11″ Clyde Boiler.
48″ x 72″ Fitzgibbon Boiler.
4 H. P. Acme Engine and Boiler.

Gas or Gasoline Engines

One 25 H. P. Toronto Junction.
One 21 H. P. New Ohio.
One 15 H. P. Pierce.
Two 14 H. P. New Ohio
One 14 H. P. Ohio on wheels.
One 12 H. P. Brantford.
Two 10 H. P. Haggas.
Three 8 H. P. Ohio, NEW.
One 7 H. P. Triton-Marine.
Two 6 H. P. Ohio.
One 6 H. P. Toronto Junction.
One 5 H. P. New Adams Marine
Four 4 H. P. New Ohio.
One 3½ H. P. Triton-Marine.
Two 3 H. P. Upright.
One 2 H. P. New Brantford.
One 2½ H. P. Goldie & McCulloch.
Four 1½ H. P. NEW and Second Hand.

Pumps

1 12″ x 7″ x 12″ Northy Duplex.
3 8″ x 5″ x 12″ NEW Duplex.
5 6″ x 4″ x 7″ " "
6 5¼″ x 3½″ x 6″ " "
18 4½″ x 2¾″ x 4″ " "
8 3″ x 2″ x 3″ " "
8″ x 5″ x 12″ Single Acting.
7″ x 4″ x 6″ " "
6½″ x 4½″ x 7″ " "
6″ x 4″ x 6″ " "
5″ x 3¼″ x 7″ " "
Several Small " "
NEW Morris Centrifugal, Nos. 2 and 4.
NEW Taber Rotary Nos. 0, 1 and 2.
3¾″ x 8″ pedestal plunger pump.
3″ x 5″ " " "
2″ x 6″ " " "
Several small plunger pumps.

Steam Appliances

NEW Pulsometers Nos. 4 to 7.
8 Steam Traps, all sizes.
150 h.p., Goldis, McC. Heater.
150 " NEW Laurie Heater.
50 " " " "
30 " " " "
40 " " Patterson "
30″ x 96″ Heater.
16″ x 50″ "
18″ x 35″ "

Engine Lathes

1 NEW 32″ x 20′ London.
1 " 32″ x 18′ "
1 30″ x 14″ Heavy bed.
1 NEW 28″ x 18′ London.
1 28″ x 18′ Dundas.
1 NEW 26″ x 16′, also 10′ bed.
8 " 24″ from 10′ to 20 ft.
9 " 18″ " 6′ to 16 ft.
1 24″ x 8′ Dundas.
1 18″ x 6′ in good order.
6 NEW 16″ from 6′ to 10 ft.
2 16″ x 6′ rebuilt.
10 NEW 15″ from 6′ to 10 ft.
4 " 14″ 6 and 8 ft.
3 " 13″ 6 " 8 "
1 14″ x 6′ Dundas.
3 NEW 12″ x 6 ft.
1 " 11″ x 60″ Barnes.
1 " 9″ x 57″ "

Cap and other Lathes

NEW 26″ x 42″ x 14′ Gap.
" 24″ x 40″ x 12′ "
" 30″ x 46″ x 12′ "
" 18″ x 32″ x 12′ "
12″ x 24″ x 60″ Dundas.
22″ x 8′ Chucking Lathe.
18″ x 8′ Davis Turrett Lathe.
16″ x 6′ Fox Lathe.
NEW 15″ x 6′ Fox Lathe.
11″ x 48′ Speed Lathe.
NEW 11″ x 72″ Barnes Foot Power.
" 11″ x 60″ " " "
2 " 9″ x 45″ " " "
No. 4½ Barnes " "
9′ x 40″ Cincinnati " "

Iron Shapers

2 NEW 24″ Back Geared Imperial.
2 " 20″ " " "
1 " 16″ " " Cincinnati.
1 " 16″ Single Geared "
1 " 7″ Rhodes.

Iron Planers

42″ x 42″ x 20′ Putman.
NEW 36″ x 48″ x 12′ London.
" 36″ x 41½″ x 10′ London.
" 26″ x 26″ x 8′ Imperial.
4 " 24″ x 24″ x 6½′ Imperial
5 " 20″ x 20″ x 5′ London.
24″ x 24″ x 36″ American.
23″ x 20″ x 5½′ American.
3 Small Hand Planers.

Drilling Machines

3 NEW 100′ Plain Radials.
2 " 72″ Universal Radials.
1 6 Spindle Multiple.
1 4 " "
2 NEW 31″ Barnes.
1 " 28″ "
1 " 24″ Cincinnati, with tapping attachment.
1 NEW 24″ London.
1 24″ in good shape.
6 NEW 20″ Barnes, B. G.
3 " 20″ " Lever Feed.
2 " 14″ Sensitive, Pedestal.
2 " 14″ " Bench.
2 11″ Plain, Upright.
1 NEW 12″ Barnes Friction.
2 " 1 ″ Friction.
1 " Fox High Speed Drill.
6 Sensitive Bench Drills, NEW.
2 Post or Wall Drills.
8 Blacksmiths' Hand Drills.
6 " " and Power Drills.

Presses and Hammers

1 No. 45 Power Press, NEW.
2 " 21 " " "
4 " 20 " " "
2 " 19 " " "
1 " 16 " " "
No. 2 Cady Press.
Heavy Bliss Stamping Press.
NEW No. 1, Challenge Soap Press.
Power Draw Press
NEW Erie 400 lb. Steam Hammer.
" 150 lb. Drop Hammer.
2 " 150 lb. Law Power Hammers.
60 lb. Palmer Spring "
NEW 50 lb. Foot Power "
4¾″ x 10″ Steam Hammer.
Several smaller ones.

Punches and Shears

1 NEW 20″ throat, London.
5 " 15″ " "
14″ throat, Bertram make.
NEW No. 5, Bremer, Single,
" " 4, " Double.
" " 2, " Single.
" " 1, " "
" " 1, " Double.
Large Power Alligator Shear.

Other Machine Tools

NEW No. 1, Cincinnati Plain Miller.
30″ x 6″ x 16″, Stevens Un. "
6 NEW Power Hack Saws.
5 Iron Frame Keyseaters.
NEW 2″ Cutting-off Machine.
" Centreing Machine.
Large Hand Screw Press.
2″ Bolt Cutter and Threader.
NEW 1½″ National Bolt Cutter.
" 1″ Acme " "
" 2″ " " "
4″, Curtis Pipe Machine.
Several Bench and Pedestal Emery Grinders all sizes.
2 NEW 2½ Ton Portable Cranes.
Crab Winches—all sizes.

Wood Planers

30″ Heavy Smoothing Planer.
27″ Cowan Double Surfacer.
26″ Mc. G. G. " "
21″ " " "
NEW 24″ x 9″ Surface Planer.
24″ Surface Planer, rebuilt.
24″ Pony " "
22″ Surface " "
NEW 16″ x 9″ Surface Planer.
" 12″ Pony Planer.
" 24″ "Handy" Planer and Matcher.
24″ rebuilt " " "
24″ Double Surfacer and Matcher.
NEW 15″ x 7″ Lightning Planer and Matcher.
13″ Fast-feed Flooring Machine.

Buzz Planers

3 NEW 12″ Pedestal.
1 12″ rebuilt.
1 10″ "
1 6″ "
58″ Stroke Jointer.

Wood Moulders

8″ 3 Side Cowan.
7″ 3 " all rebuilt.
6″ 3 " Cant, Gourlay.
6″ Sash Sticker.

Saw Tables

NEW No. 18 Combination.
2 " " 1 Clement, Variety.
4 " Variety Tables.
Dimension Saw Table.
No. 3 S. F. Rip Saw, Ballantyne.
Egan Double Cut-off Saw.
NEW Champion Cut-off Saw.
Cowan Railway " "
4 Wood Frame Machines.
2 NEW Swing Saws.
2 Rebuilt " "

Band Saws

2 NEW 36″ Pedestal.
36″ Pedestal in good order.
NEW 32″ Pedestal.
" 30″ Bracket.
30″ Bracket, rebuilt.
NEW 26″ Pedestal.

Re-Saws

Rebuilt Band Re-Saw, 54″.
40″ Galt Circular Re-Saw.
36″ " " "
Rogers Vertical "

Other Wood-Working Machines

2 NEW Heavy Shapers.
3 Rebuilt Shapers.
Galt Power Mortiser.
NEW Foot Power Mortiser.
Rebuilt " " "
4 Tenoning Machines.
2 Dowel Machines, 1½″ and 2¼″.
3 Dovetailing Machines.
36″ Double Drum Egan Sauder
3 Box-Nailing Machines.
7 Blind Slat Tenoners.
Borers and Wirers.
NEW Lath Mill, 4 saws.
Waymouth Guage Lathe.
18″ Wood Lathe.
Wood Trimmers, all sizes.
3 Self-acting Shingle Machines.
Swing Shingle Machines.
Shingle Jointers and Packers.

Saw Mill Machinery

2 NEW 3 Block Mills.
3 Rebuilt Mills.
NEW No. 4 Tower Double Edger.
" Tower Trimmer.
No. 1 Gang Edger 3 18″ Saws.
NEW Wood Frame Drag Saw.

Water Wheels

23″ Right Hand Leffel
25″ " " Farrens.
26″ Left " Leffel
30″ " " Perfection.
Water Wheel Governor.

Also the following:

Electric Motors and Dynamos.
Blowers and Exhausters.
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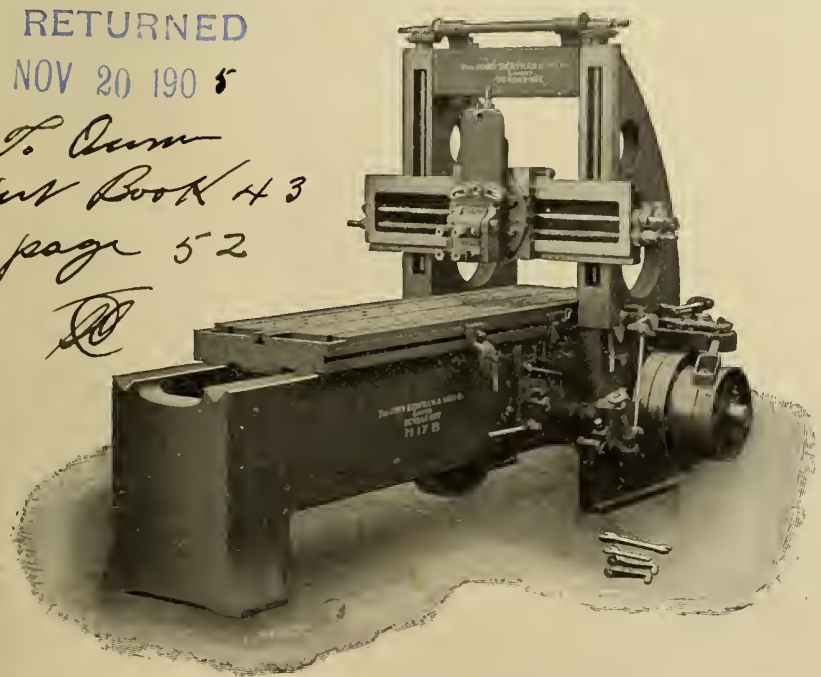

Of Bertram Planers is based on merit, which even competitors acknowledge. Why? Because they will do more work in less time than any "High Speed Return" Planers of their size on the market. This claim is made advisedly. We have got the proof and it will make interesting reading to those interested in planer progress. Write for it.

The illustration represents our 24-in. x 24-in. planer, which is shown with 6-foot table, and can be built with spur gear as illustrated, wherewith the movement of the table is at right angles to the line-shaft, or with spiral gear when the table movement will be parallel with the line-shaft. The machine is exceptionally strong and although the planer possesses quick return speed, the ALL IMPORTANT FEATURE IS THE CUTTING POWER.

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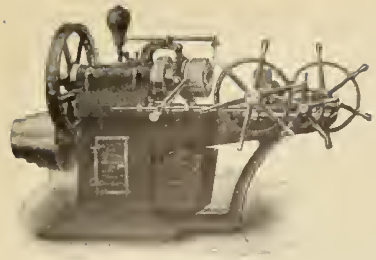

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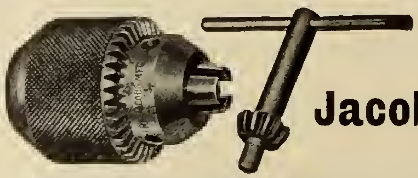

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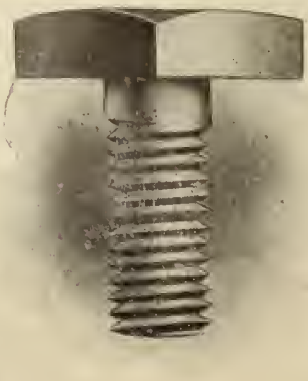

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The

John Morrow Machine Screw Co. Limited

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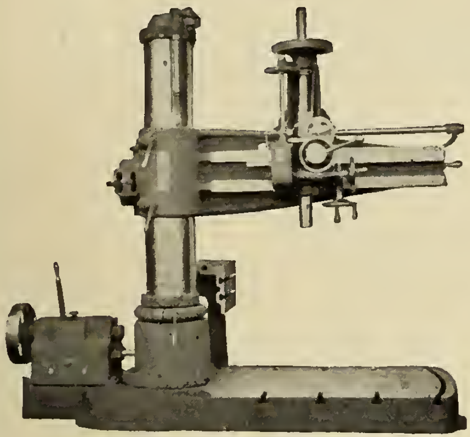

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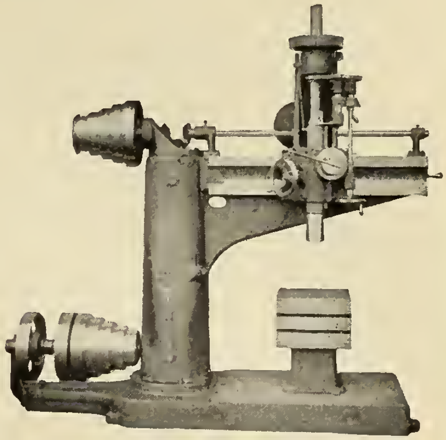
Our Radial Drills are made in five sizes, the centre of circle capacity of which ranges from 5 to 12 feet. They can be either belt or motor driven.

We build Plain Radials, Half Universal Radials, Full Universal Radials, Semi Radials, Wall Radials —plain or adjustable— Portable Radials and Special Drills.



SEMI RADIAL

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(Patent Applied for)

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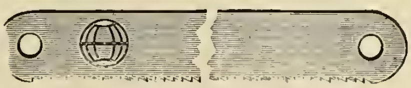

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As a rule they're **not**, and most Hack Saw users think one Hack Saw is as good as another.

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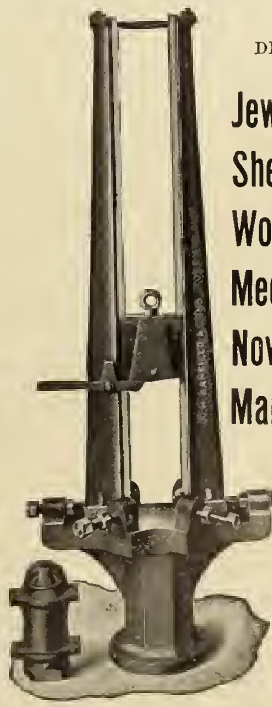

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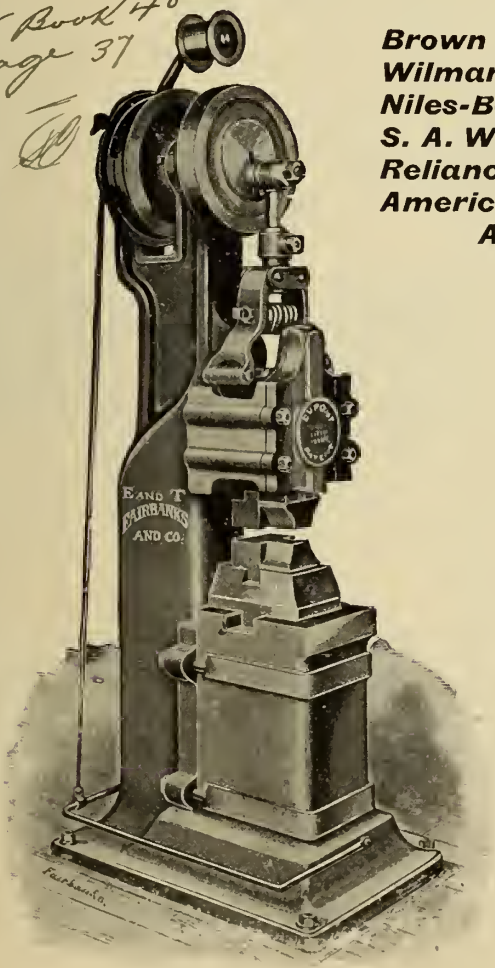

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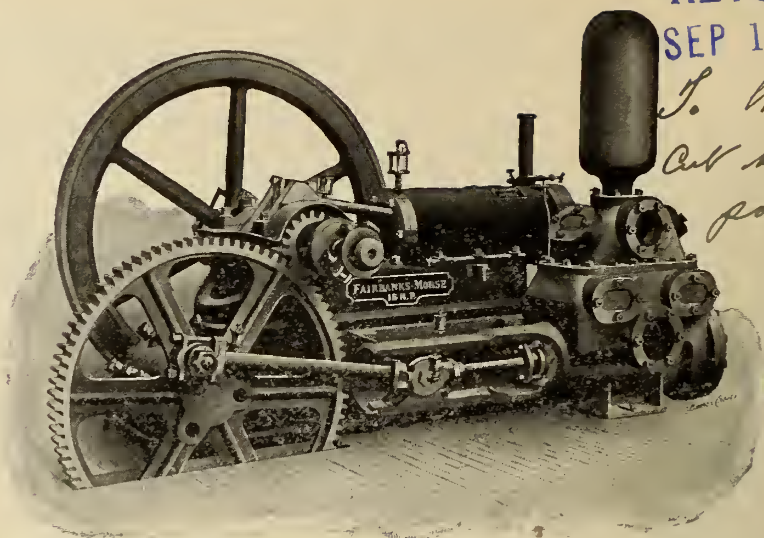

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FAIRBANKS-MORSE

PUMPS AND PUMPING MACHINERY

and respectfully solicit enquiries from users of pumping machinery for anything in this line. Fairbanks-Morse & Co. are continually adding to their already extensive line of patterns, and are prepared to offer a pump suitable for almost any service to which direct acting pumps can be applied.

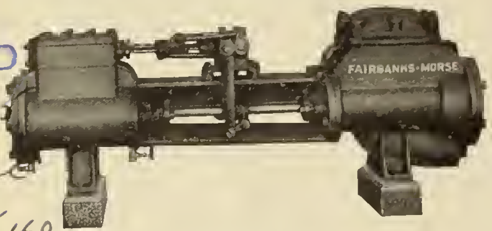


Fig. S. P. 76
Fairbanks-Morse
Duplex Piston Pattern Pump for General Service

The material and workmanship entering into the construction of our pumps is kept up to the highest standard at all times.

All wearing parts made to gauge and are therefore interchangeable.

We illustrate in the upper corner Fairbanks-Morse Combined Gas Engine and Pump which is made in sizes of 4½, 7, 9, 14, 18 and 24 H.P. This is a very simple, compact and most serviceable combination and is fully described in our Gas Engine catalog.

Fairbanks-Morse
Duplex Piston Pattern Low Service or Tank Pump

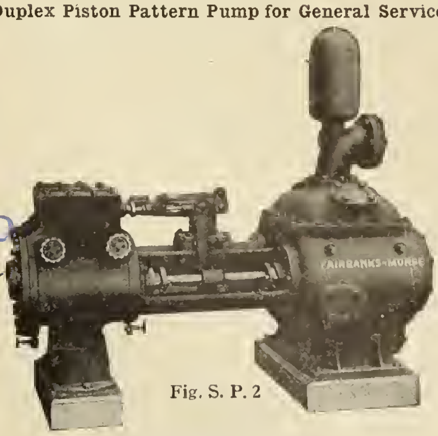


Fig. S. P. 2
Fairbanks-Morse
Duplex Plunger and Ring Pattern Pump

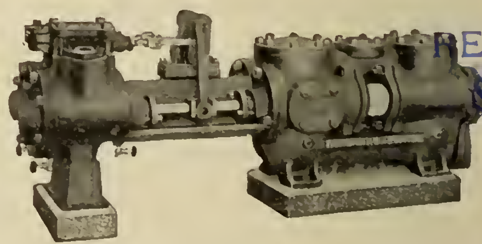


Fig. S. P. 13
Fairbanks-Morse
Duplex Boiler Feed Pump

IF YOU DO NEED A PUMP—WRITE US.
IF YOU DON'T NEED A PUMP—REMEMBER US.

Write us for Pump Catalog

THE CANADIAN FAIRBANKS CO. LIMITED

MONTREAL TORONTO VANCOUVER WINNIPEG

Machinery at the National Exhibition

A Description of the Machinery, Power and Allied Exhibits in the Machinery Hall and Elsewhere.

FROM the small child whose powers of perception and comprehension are just beginning, to the aged yet in possession of his faculties, there is magnetism and an irresistible charm about moving machinery and mechanisms of any sort. This is probably an explanation for the fact that from early morning until time for closing the aisles and corridors of the Machinery and Electrical Hall at the Canadian National Exhibition are thronged with an eager crowd of sightseers and interested spectators. The rotating shafts and pulleys, engines, both steam and gas, dynamos and motors, and machinery of different kinds in active operation, together with a brilliant display of electric lights in the several booths, keep the visitors interested from the time of entering this building until they leave. Situated to the left of the main driveway leading from the entrance gate, it is consequently missed by few who enter the grounds.

When the Exhibition was formally opened on Tuesday, August 29th, by Premier Whitney, accompanied by Prince Louis of Battenberg, and the machinery set in motion, the exhibitors of machinery, engineering supplies and electrical appliances were in readiness to receive their guests, and demonstrate to them the whys and wherefores of their different lines. The exhibits shown are for the most part of a high standard of excellence and no small credit is due those who went to the trouble and expense of making an attractive display.

On going through the building, however, one could not help being impressed by the conspicuous absence of machine tools, except in one instance, and machinists' supplies. Not a single manufacturer of machine tools in Canada amongst the many makers of first class goods had a stand. This was not due to lack of interest but more so to unavailability of space. This is getting to be more and more felt each succeeding year of the Exhibition and it is to be hoped that before the gates are opened for another year's crowd the management will see its way clear to erect a building at least twice as large as the present structure.

Machine Tools.

In the A. R. Williams Machinery Company's exhibit may be seen the only exhibit of machine tools on the Fair grounds. The exhibit is well laid out and comprises the very latest Canadian and American methods of machine construction. In the left of the exhibit is seen the McGregor-Gourlay Company's latest hollow head shaper with back gears and power down feed. On the left side is Major Harper's latest Eclipse smoothing surfacer, size 27x8, with broken rolls. This machine was admirably demonstrated during the fair by Mr. Harper, the manufacturer.

On the right side of the exhibit is a tool grinder manufactured by the Stevens Co., Galt. This machine takes care of all sorts of grinding work and has given immense satisfaction. They also show a two foot radial drilling machine, being the smallest radial drill manufactured. The machine is complete with a tapping attachment and is a very handy machine-shop tool, taking the place of a 36 to 40 foot drill press and having all the advantages of a radial drill besides.

They also show an 18x8 F. E. Reed high speed engine lathe. This is the very latest tool manufactured to keep pace with the ever increasing demand for high speed steels. Then they show the Springfield Machine Tool Company's Fox Monitor lathe with friction head, a very useful tool for brass workers. The drill press in the corner is one of the W. F. & John Barnes Company's make, it being their very latest 20 foot drill with positive geared feed containing four changes of speed.

The space allotted the A. R. Williams Co. is so small that they could not show their varied lines to very good advantage, but they made good use of the space at their disposal.

Besides the large warehouse in Toronto, the firm have branch warehouses in Montreal and Winnipeg, and are also represented in all the large centres in Canada.

Canada Metal.

The usual enterprising spirit was shown by the Canada Metal Co. in their exhibit in the Machinery Hall. The exhibit consisted of metals of all kinds, together with some manufactured goods. Of metals in ingots they had a fine display of aluminum, copper, tin and pig lead. Babbit metal of course formed a very prominent part of the exhibit, and the company no doubt are ready to demonstrate the high quality of their metal for bearings. An interesting feature of the exhibit was the display of piping, including phosphor-tin pipe, lead pipe and lock tin pipe. Of interest to electricians and wire-men was the complete

Canadian National Exhibition—A. R. Williams Machinery Company, Limited, Toronto.

display of fuse wire. Among the kinds of solder shown was wire solder for canners' use. Perhaps the most attractive part of the exhibit to those not directly interested in metals in general and also to printers was the display of type metal, including as it did several semicircular forms for newspaper presses. The company pays special attention to this line of metals, and now have very numerous customers.

Canadian National Exhibition—The United Electric Company, Limited, Toronto.

The growth of the business of this firm is shown by the extension of their plant during the past year, and from the progressive spirit ever shown by the firm. it might well be supposed that their business will continue to expand as it has done in the past.

United Electric Exhibit.

As usual the United Electric Co., Toronto, occupied the large space at the corner near the south door of the Machinery Hall. This corner was made exceptionally bright and attractive by the different colored incandescent electric light decorations and by the operating of two large D. C. generators.

One of these generatorz was belted to the line of shafting on the north side of the building. This was a 175-horsepower, 500-volt machine and supplied power for the lighting of the exhibit and also for motors and lights throughout the Exhibition grounds. The other D. C. generator, 50 k.w., 250 volts, was belted to the new Hoffman rotary engine, designed to generate 50 horse-power. This engine caused much favorable comment because of its simplicity and of the small floor space it occupies. This 50-horse-power engine on exhibit occupied about 10 square feet of space.

Besides these machines there were shown several superior type multipolor D. C. motors, and also single phase and poly-phase induction motors.

Because of the firm being so busy in moving their plant and offices to 468 King street west, they were unable to prepare in time one of their new revolving field Johnson patented alternators, neither were they able to complete any of their new multi-speed motors, also Johnson patented, in time for the Exhibition, although several of them were being prepared. This was rather unfortunate since a great many machinery-interested people who visited the Machinery Hall were very anxious to see these new types of machines.

Canadian National Exhibition—Exhibit of The Henderson Roller Bearing Mfg. Co., Limited, Toronto.

Henderson Roller Bearings

As usual the exhibit of the Henderson Roller Bearing Manufacturing Co., Toronto, seemed to attract a very large crowd. Those in charge of the exhibit were continually demonstrating the theory of the action of the Henderson bearings, and also pointing out the saving of power procured by many firms or corporations using the bearings either for shafting or for some form of truck, including street car and steam railway trucks. The application of the bearings to street and suburban electric railway trucks was shown in the exhibit. These bearings have now been installed for some time in the Hamilton, Grimsby & Beamsville Railway, on the Guelph Street Railway and on the Ottawa Street Railway, and are being tested at the present time on the Toronto Railway. Besides this the company have just completed the equipment of a train for the Canadian Pacific Railway. The order for this equipment was the direct result of the successful test of the bearings on a car for the Pullman Co. at Chicago.

The application to shafting was demonstrated by a main line of shafting and some countershafting which was run from the main line through large pulleys by means of a thread. The company have equipped a good many factories with this bearing, the latest large equipment being in the new factory of the Toronto Gas & Gasoline Engine Co. Here they supplied hangers and shafting besides the bearings.

Owing to the progress made the company have found it necessary to erect a new and much larger plant than they have at present. The new factory is situated on King street west, and is now well under way. The main building is 200x64 feet, besides an office building

40x60 feet, both being three stories high. Upon the completion of the main plant a foundry will be built, 83x60 feet.

Every power user realizes that a considerable portion of his total power is being used to run his shafting, but probably very few realize to what per cent. this considerable portion sometimes runs. If they did probably they would be more anxious than they are at present to secure the most efficient bearings for their shafting, and thus reduce to a minimum the shafting-consumed power. In commercial tests the Henderson roller bearings have been found to save from 75 to 98 per cent. of the bearing frictional loss in shafting bearings, and in a severe test on the Hamilton, Grimsby & Beamsville Railway the bearings were found to save from 45 to 50 per cent. of the power required to run the car.

The Henderson roller thrust bearing is specially adapted for propeller shafts, and this bearing has received a very satisfactory test on the steamer "Jones" of the Crawford Tug Company, Wiarton.

The Henderson roller bearing consists simply of two end rings between which the rollers are held. Between each of the large bearing rollers is a small roller which gives positive motion to each of the load-carrying rollers. Thus all the bearing rollers are running in one direction and all the small rollers in the opposite direction. This positive motion of the bearing rollers eliminates friction between the rollers and the bearing surface of the journal.

Dodge Bearings as Power Savers.

As usual the Dodge Manufacturing Co., of Toronto, make an attractive show of power transmission machinery in Machinery Hall. A new feature of their exhibit this year was a practical demonstration of the small amount of power actually required to drive shafting with ordinary babbitted bearings when both the shafting and bearings are properly finished and properly erected. A heavy steel shaft loaded with large pulleys is set up in Dodge Ball and Socket Hangers which are fitted with regular Dodge Self-Oiling Bearings (the good kind), the whole being driven at a high speed from a pulley on the line shaft above, by means of a very fine silk fish line. This was very interesting to many mechanics and power users who at first thought the Dodge Company had gone in for some new fangled sectional bearing, but when they were shown how little power there is really lost through journal friction, "under proper conditions," some of them opened their eyes, especially when they read the following card which accompanied the exhibit :

"Authorities state that in a properly designed shafting equipment the loss in power by journal friction should not exceed ten per cent. and by no means or method is it possible to reduce this loss by more than ten per cent."

And as one man of experience said, "If I saved the whole thing I wouldn't be saving much judging from the way that thing works." The Dodge Company are inviting power users to consult them on the "bearings" question.

Brass, Bronze and Aluminum.

J. N. Tallman & Sons, Hamilton, Ont., displayed their goods near the main entrance of Machinery Hall. The exhibit consisted of bearing metal of different kinds as well as castings manufactured by them, including brass, bronze and aluminum. Considerable care and manufacturing skill was shown in the arrangement and finish of the materials exhibited.

Ontario Wind Engine and Pump Co.

In the Farm Implement Building, the Ontario Wind Engine and Pump Co., Toronto, exhibited a line of gasoline engines for which they have secured the sole Canadian agency during the past year. There were a number of these engines on exhibit, and each one running made an excellent showing. These engines are the Stickney engines manufactured by the Chas. A. Stickney Co., St. Paul, Minn. These engines are new on the Canadian market, and thus a short description of them will be of interest.

The water and gasoline tanks are attached direct to the engine. The electric igniter is easily accessible. The spark coil is contained in a cast-iron waterproof case. Current is supplied by a set of water-proof dry batteries. The air pipe is so arranged that the temperature of the air admitted to the mixer can be varied to suit the weather conditions by

Canadian National Exhibition—Dodge Shafting and Pulley Exhibit.

means of a heater about the exhaust pipe. The engine is governed by cutting off the supply of gasoline and vapor and disconnecting the sparking apparatus. These engines are designed for all power purposes.

Canadian National Exhibition—Fairbanks-Morse Gas Engines and Engineering Supplies.

The Canadian Fairbanks Co., Limited.

The Canadian Fairbanks Co.'s exhibit in Machinery Hall is one which attracts a great deal of attention. It is splendidly arranged, and is representative of their leading lines. Their display of Fairbanks Standard Scales is indeed a credit to them, scales of all sizes and for all purposes being tastefully arranged. Viewing it one cannot but feel that they have justly earned the world-wide reputation which they enjoy.

As already mentioned in our previous editions of Canadian Machinery, the Canadian Fairbanks Co., Limited, are now the exclusive Canadian selling agents for Fairbanks, Morse & Co.'s lines of gas and gasoline engines, steam pumps, windmills, hand push and motor cars, etc. They are now building a Canadian factory to be located in Toronto, where all these lines will be manufactured. The exhibit of gas and gasoline engines is a creditable one. Their farm engine, known as "Jack of all Trades," was one which attracted considerable attention, being in constant operation and seemingly perfect in every detail. This is an engine of 2-horse-power, being specially designed for farm use. It will pump water, saw wood, shell corn, run cream separators, etc. Their line of vertical and horizontal engines showed up exceedingly well, all running constantly.

Their pyramid of Fairbanks' wood split pulleys "Made in Canada" attracted much attention. They had in connection with this exhibit an unfinished pulley, which clearly showed the superior points in the construction of the Fairbanks pulley.

They also displayed a complete line of Fairbanks' asbestos and bronze seated globe and angle valves, both brass and iron; Pratt & Cady renewable seat ring gate valve and check valves; the genuine Pratt & Cady asbestos packed steam cocks; Dart's patent bronze ground joint unions; Yale & Towne's chain hoists, as well as a Taylor & McKenzie hand punch that was worthy of more than passing attention.

Saw Mill Machinery.

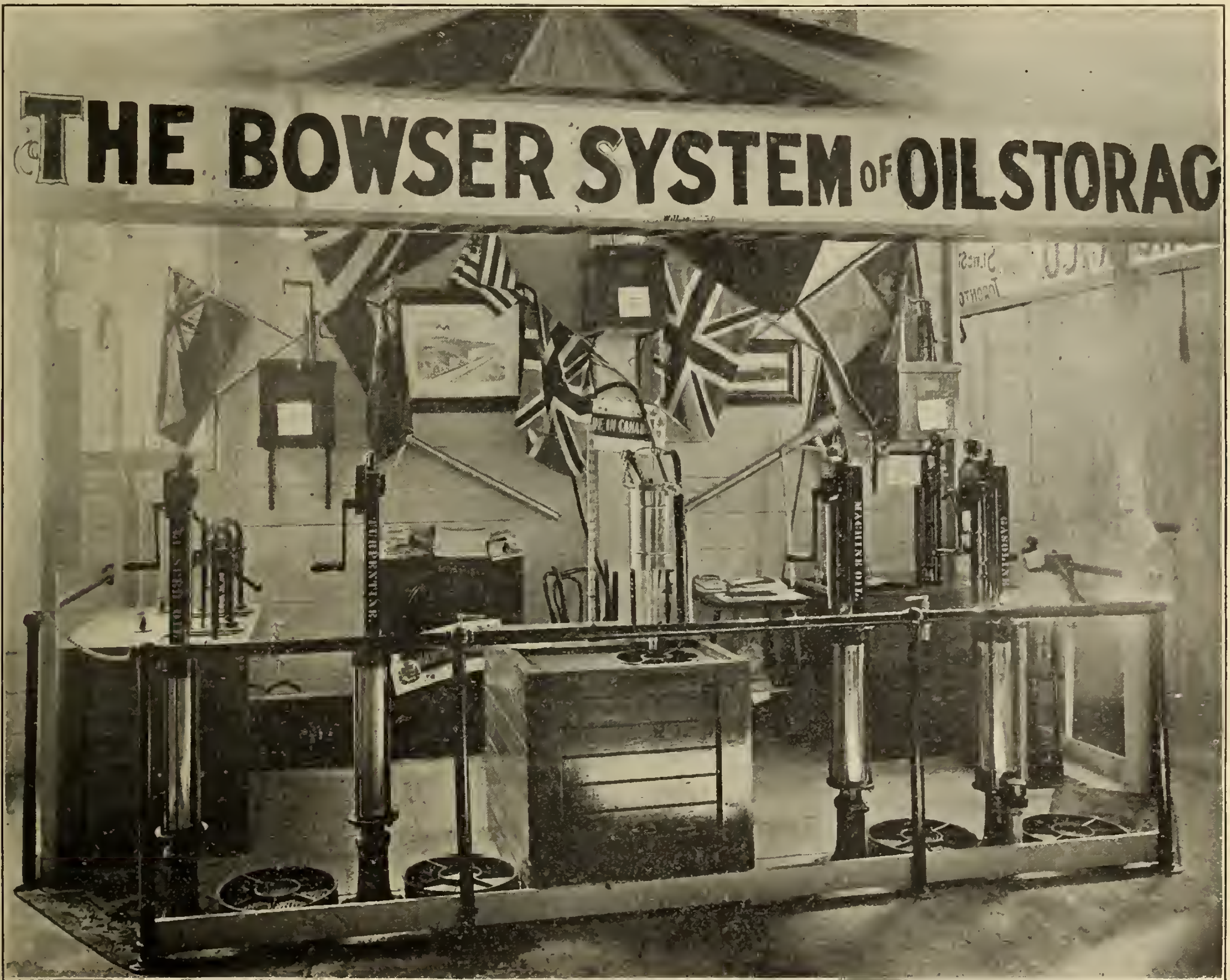
E. Long Manufacturing Company, Orillia, are exhibiting saw mill machinery exclusively, conspicuous amongst which is a complete saw casing and frame suitable for portable mills having a capacity of from 5,000 to 15,000 feet of lumber per day. It is fitted with all the latest improvements known to such machines. These include cable feed works, a carriage fitted with overhand ratchet set-works, coil spring receder band-break which clamps the head block in any desired position at any time. Plant shown is fitted with a 56-inch saw. Besides this were noticed two sizes of double edgers, one a two-saw machine and the other three. The points of these machines are based on the fact of their having extra heavy mandrils and large driving pulley, besides the adoption of a looseing bearing at the end by means of which saws may be easily removed and replaced. Feed rollers are located close to the saws. A couple of head blocks are also shown. These are made of cast steel for heavy saw mill equipment. With these machines is shown a number of circular saws manufactured by E. R. Burns Saw Co., of Toronto, for whom the E. Long Company are representatives.

Waterous Engine Works Co., Limited, Brantford.

Although this firm are large manufacturers of engines and boilers, they are exhibiting only one of their new style of gasoline fire engines. The fire engines manufactured by this firm are already well known throughout Canada. Formerly all those manufactured were run by steam but in keeping with the times and coincident with later development, this firm has designed and placed on the market the engine mentioned above, which is the first of this kind to be man-

Canadian National Exhibition—View Showing Some Fairbanks Scales.

ufactured in Canada and shown to the Canadian public. It bears a card stating that it has already been sold to the municipality of Beaverton, Ont. The essential difference between this and former engines lies in the fact that the pumps are run by a gasoline engine and consequently can be started in a very short time, thus precious moments for fighting a fire are available that with a steam engine were lost. A 15-horsepower engine is used, running at 300 revolutions per minute. The pumps are



Canadian National Exhibition—The Bowser System of Oil Storage.

of the rotary type developing 125 lbs. pressure and pumping 350 gallons per minute, forcing a stream to a height of 150 feet.

The Bowser Oil Tank.

Few exhibits at the Exhibition were of greater general interest than that of the Bowser system of oil storage, better known as the Bowser oil tank. Situated at the extreme easterly end of Machinery Hall, the exhibitors were allowed a remarkably small space and were compelled to leave out one of the best features of their exhibit after having specially prepared for the display.

The showing was, however, a remarkably good one and hardware merchants, grocers, manufacturers and heads of large industrial plants were found at all times at the booth securing information regarding the Bowser system, and studying the working of the perfect self-measuring and perfection syphon.

S. F. Bowser & Company, the patentees of the system, manufacture at 530 West Front street, Toronto, and Fort Wayne, Indiana, pumps and tanks for the storage and handling of oils of all grades, delivery being made direct to the customers' cans in retail stores, direct to autos or launches, direct to the oilers used around mills or factories, and to the mixers in paint works. The system offers economy in oil and in labor with perfect safety and cleanliness as well as checking purchases and sales. Possibly the most important outfit is one for handling gasoline or benzine consisting of a tank of heavy galvanized sheet steel placed outside the building, either buried in the ground or in a shed and attached to a powerful pump inside the building capable of squirting an exact gallon, half gallon, quart or pint of oil from such outside tank a distance of 250 feet direct or up to any reasonable elevation.

The Borden Co.

On the right hand of the entrance leading to the boiler room, the compact and well arranged exhibit of the Borden Company, manufacturers of hand and power pipe-threading machinery, hand stocks and bolt stocks, 16 Sheppard street, Toronto, is situated. The solid adjustable dies as applied to these hand stocks and hand and power machines is a distinctive feature and demonstrates itself in being simple, more practical and easier running, such as is well suited to meet the requirements of the trade. All the dies are constructed with inserted segments of high grade steel, which can be replaced, when worn out, at a small cost. The hand machines are constructed entirely of malleable iron and each

one carries with it an unconditional guarantee. The Borden Company, to show the confidence they have in their hand machines, are willing to loan to any one sufficiently interested one of these machines on ten days' free trial. Another feature in connectian with these machines is their saving in time, which alone is a very important consideration to anyone having occasion to use threading machinery.

Exhibit of Dominion Belting.

Large maple leafs characterized the belting exhibit of the Dominion Belting Co., Hamilton, in the Machinery Hall. It consisted of three large piles of their "Maple Leaf" stitched cotton duck belting, tapering from bottom to top in different sizes. The dressing made specially for this belting was also on exhibit, the whole making a neatly arranged and interesting display.

"Maple Leaf" belting is made from duck specially woven for this firm, and contains the least possible stretch with the greatest consistent strength. It is machine folded and lock stitched with special strong cord, each row of stitching being entirely independent of the other rows. The belts are waterproofed and are rendered impervious to steam, oil or gasses, and remain flexible under afl conditions. It is uniform in weight and can be made any length desired without joints, endless belts being a specialty.

This belting is manufactured with machinery of patented design, gotten up by the company, and there is only one style of belting made by them, the "Maple Leaf." For main drives and heavy work such as lumber mills, brick-yards, mines, etc., "Maple Leaf" belting is specially efficient. During the last year the company have done a very large business in main drive belts. For this purpose the company claim that the "Maple Leaf" is the surest belting on the market. During this season they have sold over 200 belts in the 12 to 30 inch sizes. Until they started three years ago the Dominion Belting Company claim that the production of belting for main drives was in an experimental state, but since then "Maple Leaf" makes a sure drive.

Canadian National Exhibition—Dominion Belting Exhibit.

"Maple Leaf" belting is now stocked by hardware merchants from the Atlantic to the Pacific and in all sizes.

What users say for an article is very significant, and any wishing to get a book of testimonials should apply to the Dominion Belting Co. Among those who give flattering testimonials are: Laking, Patterson & Co., Hamilton; Imperial Paper Mills of Canada, Ltd., Sturgeon Falls; the Good Roads Machinery Co., Ltd., Hamilton; the Lachute Shuttle Co., Ltd., Lachute Mills, Que.; Wm. Laking, Haliburton, Ont.; F. W. Fearman Co., Ltd., Hamilton; the Dowswell Mfg. Co., Ltd., Hamilton; Canada Linseed Oil Co., Ltd., Montreal, and others.

N. H. Walker and R. N. Rose had charge of the exhibit, their geniality making many friends for their company as well as leaving possible customers with a favorable impression of the goods.

D. K. McLaren Belting.

D. K. McLaren, Montreal and Toronto, had his usual exhibit of belting, the four kinds being shown in many sizes. The exhibit consisted principally of pyramids of the "Genuine Oak" belting, rubber belting, Baltimore belting and American duck belting. There was also exhibited a show case af mill supplies.

Toronto Gas and Gasoline Engines.

This firm had a large and comprehensive exhibit of engines, marine, stationary and portable, and motor boats in the Implement Building, besides motor boat supplies of all kinds. Of most interest to power users was that part of the exhibit devoted to stationary engines. There were four of these engines of different horse-powers running. Besides the stationary engines there were shown a portable gasoline engine, a full line of motor boats and marine engines. These marine engines are of the opposed cylinder type. In the exhibit two of them were driving propeller shafts, the propellers being situated in boxes containing water to show manner of reversal. The launch supplies were displayed very effectively in a handsome upright show-case.

Since last Exhibition time the growth of the company's business has demanded increased capital and also more commodious quarters. This led to the reorganization of the company with increased capital under the name of The Toronto Gas and Gasoline Engine Co., Limited, and also the building of new works near the Exhibition grounds where additional machinery has been installed. The management, however, has not been changed, and under them the business will continue to expand as it has done in the past, the output having grown from two or three engines per month to

the capacity of the new plant, which is about fifty engines per month.

This company make stationary engines suitable for all kinds of power purposes including machine shops, wood-working shops, blacksmith shops, plumbers' shops, etc.

Gas and Gasoline Engines.

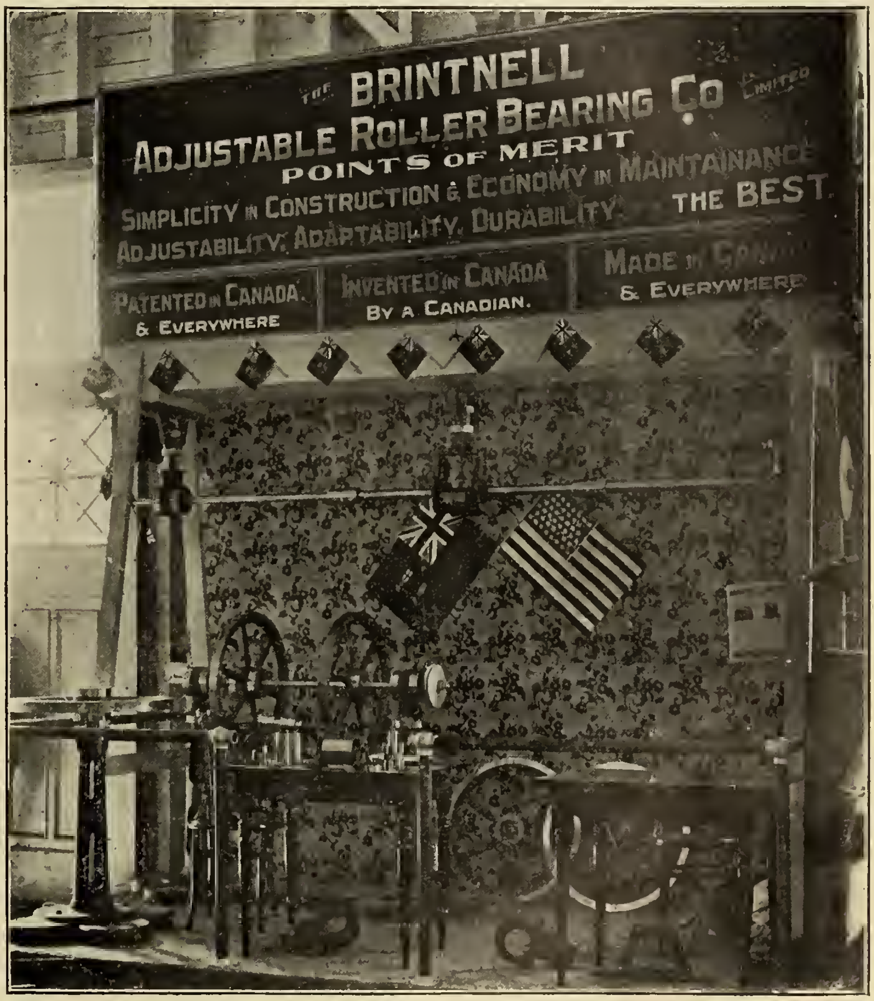
Gas engines of various styles and sizes are in operation in the somewhat spacious allocation of Goold, Shapley & Muir Co., Brantford. The main exhibit consists of Ideal gas and gasoline engines, both for stationary and portable purposes. A notable feature of this exhibit is a gasoline engine in operation running a large power double-action piston pump, the latter also of the firm's make. It shows the utility of such a combination whether desired for private use or for public corporation. There is also shown a grain grinder for farmers' use which may be operated by any power. Of these a good many have been sold to be used in conjunction with gas engines. While not exhibiting, this firm also manufactures the Imperial windmill. The engines in active operation include a 5 h.p., a 12 and 18 and 8 h.p., making in all a showing that is bound to catch the eye and arrest the attention of the passer-by. Just outside the space allotted is one of their cement concrete mixers operated by a 3 h.p. gas engine. This comes in for no small share of attention on account of the fact that it is entirely new, being designed and built by this firm exclusively.

The Motive Power Supply.

A neat, enclosed office beside which is placed one of their Ideal engines, marked the stand of the Goldie & McCulloch Co., Limited, Galt, which was situated immediately to the left of the centre aisle leading to the main entrance of the Machinery Hall. Besides these, however, Goldie & McCulloch apparatus are playing a further part in the operation of the Machinery Hall, as one of their 100-horse-power engines owned by the Exhibition management runs the shafting along the northern side of the building. Both engines are supplied with steam from two Goldie & McCulloch horizontal return tubular boilers, 72 in. by 16 feet, working at 110 lbs. pressure. These two engines not only run the line shafts of the Machinery and Electrical Building, but are also used to run the generator to supply electrical power for the Process Building as well as the lighting for the Midway. The engine showing the exhibit is in active operation as stated, running the line shaft on the south side of the building. It develops about 80 horse-power at 250 revolutions per minute. The smoothness of operation of this engine is at once noticeable and attracts the attention of visitors passing along the aisle. Another feature in connection with this is that it is self-oiling and thus requires a minimum of attention.

A Newer Roller Bearing.

Immediately to the left on entering the western door, the merits of the Brintnell Adjustable Roller Bearing were exemplified in a compact exhibit. Mr. A. H. Brintnell, the inventor, explained the principle of this new bearing to the numerous inquirers. The exhibit consisted of an overhead shaft, the hangers being also a new feature for shafting, and a shorter length supported on pedestals. It was at once apparent to the spectator the ease with which a shaft revolving in these bearings turns. The bearing saves from 40 to 90 per cent. of the friction losses. The principle of the bearing is essentially one of simplicity, consisting of a series of rollers attached to a central annular ring, and are used with the shaft revolving inside the circle of rollers or outside a set differently adjusted. The ease with which these bearings can be adjusted is another feature, as they can be manipulated as easily as the old two-part boxes. With a one-inch roller, from 3 to 10 inches of contact surface is given, according to the method of installation. It is claimed for this bearing that it is composed of from 5 to 40 less parts than any other recognized roller bearing. The invention is the result of about five years' study and research on the part of the inventor. The sign above the exhibit reads "Patented in Canada and everywhere. Invented in Canada by a Canadian, made in Canada and everywhere." A company has been formed, known as the Brintnell Adjustable Roller Bearing Co., Limited, 249 Yonge street, Toronto, and it is expected to place these bearings on the market at an early date and to be able to sell them at an extremely low cost.

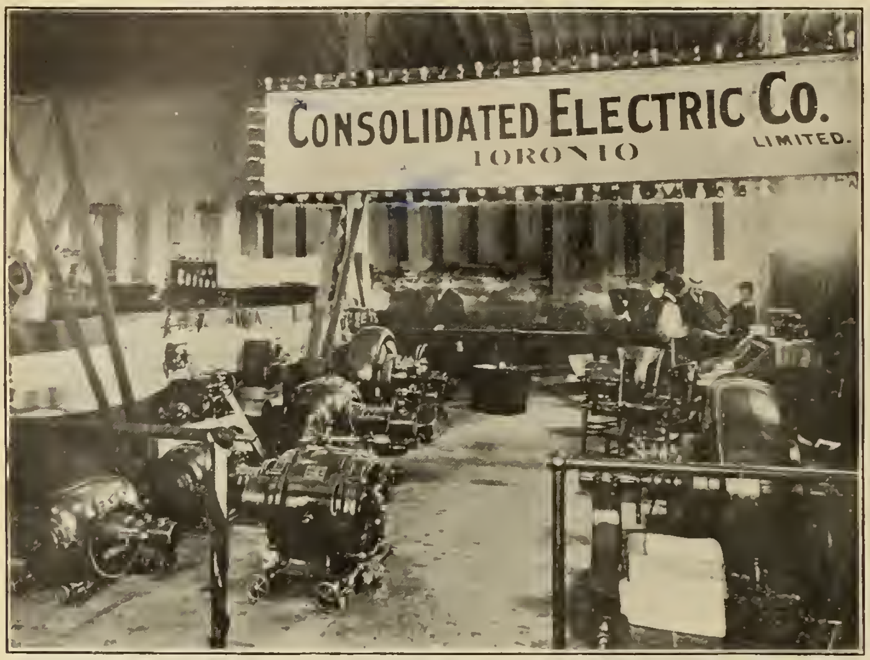


Canadian National Exhibition—Exhibit of The Brintnell Adjustable Roller Bearing Co., Limited, Toronto.

Babcock & Wilcox.

One of the Babcock & Wilcox steel water tube boilers of the Standard Land type was the main feature of the Babcock & Wilcox exhibit, which occupies a position running from aisle to aisle near the centre of the Machinery Hall. The boiler was complete in every detail except for the fact that apart from a

distance of a couple of feet high, the brick casing used in the water installations was omitted, thus showing to view the features of this high-grade boiler. It



Canadian National Exhibition—Consolidated Electric Company, Limited, Toronto.

was equipped with all fittings and showed to splendid advantage. On shelves nearby some of the special forged steel parts used in the construction of these boilers were displayed. The partitions between this and the two adjoining booths were covered with green burlap, upon which pictures representing different Babcock & Wilcox installations were artistically grouped.

Many Motors and Generators.

King Edward induction motors and direct current motors are exhibited by the Consolidated Electric Company, Toronto, in a spacious booth which is overhung with a large sign bearing the name of the firm and framed with various colored incandescent lamps. The machines vary from one-eighth to 40-horse-power and besides being attractive to the beholder embody other qualities that give them value, such as smoothness of running, careful and substantial construction and high grade material. The firm is busily engaged preparing a large number of the induction motors such as are exhibited and for which orders have already been received to be used when Niagara power is transmitted to Toronto. One of the particular features of this exhibit is an alternator running from the line shaft designed to give frequencies of 25, 33, 40, 50, 60 and 66 cycles for 1, 2 and 3 phase and any voltage between 110 and 1,050. It was designed for testing machines going to different towns, where their distributing systems are different.

In the exhibit this machine is running two induction motors, one sixty cycles and the other twenty-five. A 30-k.w. direct-current generator, also running from the line shaft, supplies current for several motors, ranging from one-eighth to 25-horse-power. The 5 k.w. generator supplies current for the lighting exhibit of one of the other booths, and a 9 k.w. machine supplies the colored illumination for the firm's exhibit. In all this is a very interesting exhibit whether from the standpoint of the spectator or from a technical point of view.

Canadian National Exhibition—Exhibit of The Jones Underfeed Stoker, Toronto.

Underfeed Stoker Co., Limited, Toronto.

The absence of smoke issuing from the power chimney situated beside the Machinery Hall is due to the fact that the boilers in the power house are equipped with two Jones Underfeed stokers. They are provided with 12-inch cylinders and a 9-inch ram, while the hopper above holds about 130 lbs. of coal. The main point upon which stress is laid in connection with the Jones Underfeed Stoker is the fact that both air supply and coal supply are regulated automatically. A ventilating fan driven by a high-speed engine provided a draught for the boiler and the same engine controls the valve motion which regulates the coal supply furnished to the fires. Thus the air and coal are in direct proportion. If the pressure rises the engine is governed to slow down and thus less air and less coal are supplied to the fire, while on the other hand if the pressure drops the engine speeds up, more air and more coal are supplied, and thus pressure is increased. While thus supplying proper relative proportions of coal and air, almost perfect combustion is the result. An analysis of the ash taken from the fires where one of these stokers is at work is found to amount to practically the same as a chemical analysis of the coal. This feature of air and coal regulation is unique in the Jones stoker. At their exhibit the fire doors of the boilers are closed at 8 a.m. and not opened again till 6 p.m., when the fire is raked and the clinker taken out. It comprises the earthy material of the coal but beyond this there is little residue. With this stoker the boiler may be forced 100 per cent. for considerable periods.

Filter and Presses.

As is the case with some of the other exhibits, flowing water at once attracts the attention of those passing along the south aisle of the Machinery Hall to the booth occupied by Wm. R. Perrin & Co., Toronto. The central feature of the

(*Continued on page 357.*)

Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

ALTERNATORS IN PARALLEL.

To run two alternators in parallel, several conditions have to be fulfilled. The incoming machine—as in the case of direct-current machines — must be brought up to nearly the same voltage as the first one ; it must operate at exactly the same frequency ; and, at the moment of switching in parallel, it must be in phase with the first machine. This correspondence of frequency and phase is called "synchronism."

It is impossible with mechanical speed-

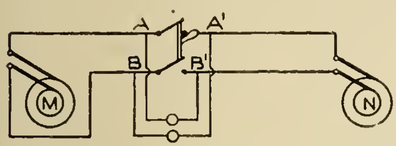


Fig. 1.

measuring instruments to determine the speed as accurately as is necessary for this purpose. There is, however, a very simple method of electrically determining small differences in speed or frequency. In figure 1 let M and N represent two single-phase alternators, which can be connected by means of the single-pole switch AB. Across the terminals of the switch is connected an incandescent lamp, L, capable of standing twice the voltage of either machine. When AB is open the circuit between the machines is completed through L.

The two machines may be connected in parallel as follows : Assuming machine M already in operation, bring up machine

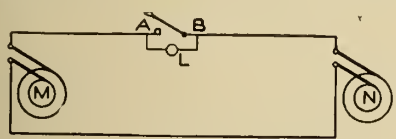


Fig. 2.

N approximately to the proper speed and voltage ; then watch lamp L. If machine N is running a very little slower or faster than machine M the lamp L will glow for one moment and be dark the next. At the instant when the voltages are equal in pressure and phase L will remain dark ; but when the phases are displayed by half a period the lamp will glow at its maximum brilliancy. Since the flickering of the lamp is dependent upon the difference in frequency, the machines should not be thrown in parallel while this flickering exists. The prime mover of the incoming machine must be brought to the proper speed ; and the nearer machine N approaches synchronism the slower the flickering. When it is very slow, we can use the moment the lamp is dark to throw the machines in parallel by crossing the switch AB. The machines are then in phase, and tend to remain so, since, if one slows down, the other will drive it as a motor. It is better to close the switch when the machines are approaching synchronism than when they are receding from it—that is, at the instant the lamp becomes dark.

This method of synchronizing is open to the following objections :

1. The lamp may be dark with considerable difference in voltage. For instance, a 110-volt lamp is dark with a pressure of 20 to 25 volts.

2. The lamp may be dark owing to a broken filament. It may thus happen, with this arrangement, that the machines are placed in parallel while there is a considerable difference in voltage or phase existing, and an excessive rush of current will result.

A method not open to the above objections is shown in figure 2. The machines to be switched in parallel are each connected to the bus-bars by means of double-pole switches. Two incandescent lamps, of the machine voltage, are cross-connected as shown. If the machines are in phase and the voltages generated are equal in value, the difference of potential between A and a given point is the same as that between A and the same point ; likewise, B and B' have the same relative potential values. Hence a lamp connected between A and B' would burn with the same brilliancy as if it were connected directly across AB ; likewise with the other lamp. If, however, the machines happen to be directly opposite in phase, but to be generating voltage of the same value, A and B' are of the same relative potential value, and B and A' are likewise of the same value ; hence lamps cross-connected as in figure 2 would be dark. At any other phase difference, the lamps will glow, but not so brightly as when in phase. Hence, with this arrangement, the machines should be thrown in parallel when the lamps are on the verge of maximum brightness, a condition readily determined but not possible with the first method.

The connections as shown in figures 1 and 2 are not directly applicable to high-tension working, but require the introduction of transformers as shown in figure 3, which is a modification of figure 2. The secondaries (of, say, 50 volts each) should be connected in series with each other and to one 100-volt lamp. When the two machines are opposed in phase, the lamp is dim. If the lamp flickers badly, the phase is not right ; but if the lamp is steady at full bright-

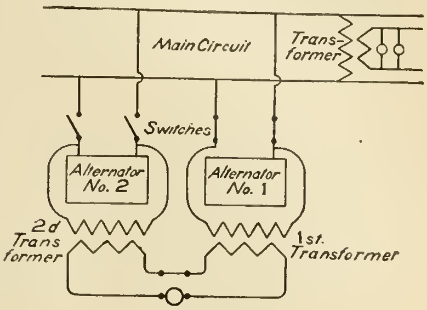


Fig. 3.

ness the machines are in phase, and they may be connected without disturbing the circuit, by closing the main switch.

If alternators are rightly connected to each other or to the engine, so that they necessarily run exactly together, there is no need of bringing them into step each time, but they should be adjusted to the same phase in the first place.

The connections of the synchronizing lamps of a three-phase system are similar to those for a single-phase system. For instance, the method employed in

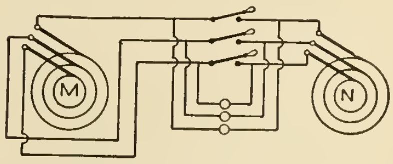


Fig. 4.

figure 1 may be extended, and lamps connected as in figure 4. If the three lamps become simultaneously dark or bright the connections are correct, and the three switches may be closed at an instant of darkness. It may happen, however, that the lamps do not become bright or dark simultaneously but successively. This indicates that the order of connection of the leads of one machine does not correspond with that of the other. In this case, transpose the leads of one machine until the proper or simultaneous action of the lamps is obtained.—Technical World.

MUNICIPAL OWNERSHIP.

IT had been supposed that Glasgow headed the list of cities with a multiplicity of municipal enterprises, but Freiburg, Germany, runs it a close second. The following is a little list of some things it does for a population apparently incapable of doing much for itself :

1. Four hundred cottages, each with a little garden. Over $370,000 has been spent by the city to give the poorer citizens better homes.

2. Electric street cars. The fare to any part of the city is 2½c.

3. Fifty advertising boards. All outdoor advertising is controlled by the city. The rate is 10c. a day per square foot.

4. Pawnshops. The city owns all the pawnshops and charges a low rate of interest. It does not try to make any profit, but runs the pawnshops at cost.

5. Savings bank. The city owns the only savings bank in Freiburg. It has over $5,000,000 in deposits.

6. Theatre. The principal theatre at Freiburg is owned by the city. The citizens regard the theatre as part of their educational system.

7. Restaurant. There are public restaurants in Freiburg which serve breakfasts and suppers for 5c., and dinners for 6½c. The citizen can get a good cup of coffee and two thick slices of bread for 2½c.

8. Burial of the dead. The city has taken over the undertaking business. The cost of a funeral in Freiburg runs from $5 to $32.

9. Farms and forests. The city has bought large tracts of land near the city, so that work may be given to any workmen who need open-air jobs for their health.

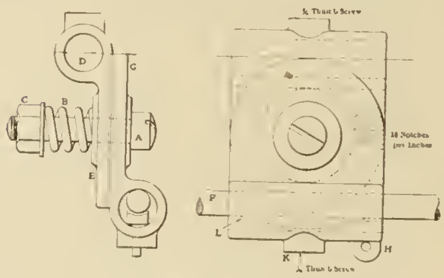
10. Correct time. A $5,000 electric clock has been placed in the city hall. This clock connects with eighty-five other clocks in different parts of the city.

11. Electric light. The city manufactures all its own electricity, both for light and power.

12. Architects. Freiburg pays a salary to the best architect in the city as a kind of building department.—Electrical World and Engineer.

AN ADJUSTABLE LAMP HOLDER.

THE sketch shows the principal parts of the simplest incandescent lamp-holder that I have ever seen. It consists of two similar brass castings, made with five teeth on their inner faces and fastened together by the bolt A, with spring B and nut C. Through hole D of piece E slips a half-inch cord-rolled rod, which is fastened up in any convenient way. We used them fastened to upright rods bolted to the lathe carriages so the lamp would travel with the carriage. We had some on the setting-up floor fastened to upright rods set in heavy bases, so that we could move them around, and we had some on swinging rods hinged to the walls and posts. Through hole F of piece G we ran a piece of 5-16-inch cold-rolled rod, which was fitted at one end and drilled about ⅛-inch. This was to hang the lamp to. A small wire hook was lashed to the lamp cord, just above the lamp, and hooked into the end of this rod. The lamp cord was also fastened at the ear H, so as not to have it lying on the floor. By having a set-screw at K, and a spring L, we could adjust the tension so that the rod could be slid in and out readily. Nut C was a finger fit, so that we could vary the tension on the joint easily. We needed to do this as when the joint was adjusted to hold out a lamp horizontally 5 or 6 feet away it was set altogether too stiff for short-range work. As I remember, the total expense of these holders for a lot of fifty was something less than fifty cents each not including the wiring up. They would



Incandescent Lamp Holder.

perhaps be hardly suitable for an office, as the teeth between pieces E and G are rather noisy, but they answer every purpose in the shop.—American Machinist.

A POINT FOR THE PURCHASER.

THE purchase of improved equipment in these days almost always implies the desire on the part of the buyer to obtain the utmost advantages possible from his physical plant, so that his production economy may be increased through the reduction of operating expenses per unit of output. It is often possible for a purchaser who has expended a large sum of money for the most modern machinery to turn that equipment to good account for advertising purposes, informing his customers of his improved methods of doing business through small descriptive booklets illustrated by pertinent photographs and by encouraging visitors to inspect his premises. The growing public interest in electrical appliances renders this an easy task in retail houses making wide use of electric motors or special lighting equipment, and there is no doubt that many purchasers of such machinery do not as yet appreciate the possibilities in this direction.

The advantages of electric lighting and power over gas, oil and antiquated shafts and belts are so striking that it is a pity for a merchant who has paid the price of such improvements not to turn them to account in every possible way. An electrically driven and heated laundry offers a fertile field for advertising suggestiveness; a motor-driven bakery appeals at once to discriminating customers as a cleanly establishment in comparison with older houses; while a finely lighted store or office is its own index of progressiveness. If some of the engineering salesmen in the district offices of the large companies would bring this matter home to their customers, it is safe to say that even greater satisfaction would be obtained from modern equipment by its purchasers.—Electrical Review.

HOME-MADE SOLDERING IRON HEATER.

A VERY convenient electric soldering iron heater is in use at the Druid Hill sub-station of the United Railways & Electric Co. in Baltimore. It is a simple, home-made affair, consisting of a bank of five 110-volt lamps, a copper plate bent at right angles, an arc lamp carbon 5-8 inch in diameter, and suitable connecting wires. The copper plate is mounted upon an ordinary fire brick, and the carbon is allowed to rest upon another, a fire-brick cap being placed upon it, sufficiently channelled out to enable the end of the carbon to be well covered. The carbon is connected to the positive terminal of the trolley circuit and the copper plate to the negative, the lamp resistance being interposed to cut down the potential.

The heater is operated by bringing the carbon against the copper plate, and withdrawing it, forming an arc which quickly heats the plate sufficiently to enable soldering to be done. The use of the gasoline torch is entirely dispensed with, and once the copper plate is heated, it readily stays hot with little attention. The cleanliness and convenience of the apparatus are notable. A small electric soldering iron for delicate work is also in use at this sub-station. It consists of an insulated handle carrying two terminals with sufficient spring to enable an arc to be established between them when they are pressed together and separated. Suitable resistance is interposed between the power circuit and the arc points to prevent undue rush of current.—Electrical Age.

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

NOTES ON VALVES.

AMONG the requirements of a good valve are sufficient weight of metal to prevent its being bent or sprung out of shape when connected with the piping; valve seats that are easily repaired or renewed; freedom from pockets or projections which may catch dirt or scale, and construction permitting the easy packing of the stem or spindle.

Gate valves offer very little resistance to the flow of steam or liquid passing through them, and are generally used in the best class of work. The general construction of this type of valve is shown in Figs. 1 and 2, which represent the "inside" and "outside" patterns of the Chapman valve. In the former the spindle remains stationary, so far as any vertical movement is concerned, and the gate or plug being attached to it by means of a threaded nut rises into the bonnet when the spindle is revolved. With this form of valve it it impossible to tell by its appearance whether it is open or closed unless provided with some special indicating device. With the outside screw, the upper portion of the spindle is threaded, and is operated by a revolving nut which is journaled in the yoke and turned by the hand-wheel. The operating screw of this valve is entirely outside the valve body, where it can be inspected and oiled, thus facilitating easy operation, and the spindle rises through the stuffing box without turning, which allows the packing to be kept tight without difficulty. With valves of this type the attendant can tell at a glance whether they are open or closed. For these reasons outside screw-valves are preferable for high-pressure work, and especially so for the larger sizes. In the case of low-pressure heating work, the inside screw is more commonly used. The Chapman gate or plug is made wedge-shaped, and presses against ground seats when closed. The seats are made both solid and removable, and of various materials for different pressures.

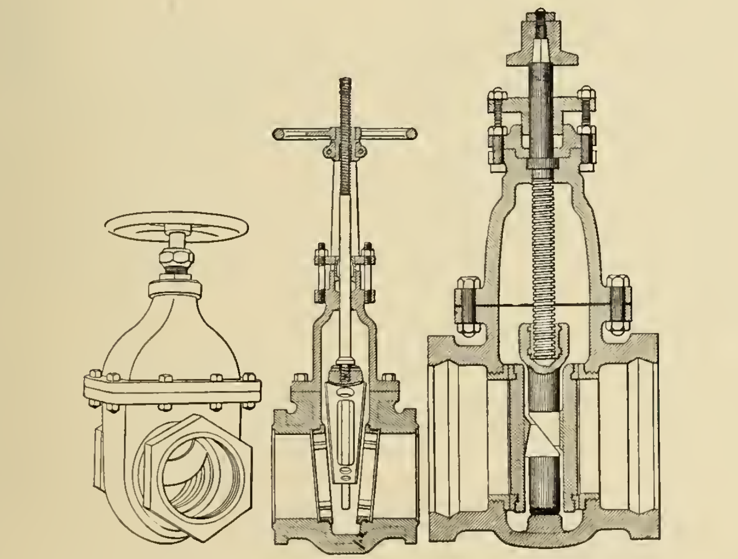


Fig. 1—Chapman Gate Valve. Fig. 2. Fig. 3—Ludlow Gate Valves.

Gate valves of different makes vary chiefly in the smaller details of construction. In the Ludlow valve the plug or gate is made in two parts, having their outer faces parallel, as shown in Fig. 3, instead of being wedge-shaped, as shown in Fig. 2. Between these two parts is a wedge with the thicker end at the bottom. When the valve is closed, the plug first descends and loosely closes the opening; then a further movement of the stem brings the two parts of the gate hard against the wedge, which forces the outer surfaces tightly against the seats.

Globe valves should always be set to close against the pressure, for if placed in the opposite direction they should not be opened if the valve should become detached from the stem, and no indication of the trouble would be given by the action of the stem under these conditions.

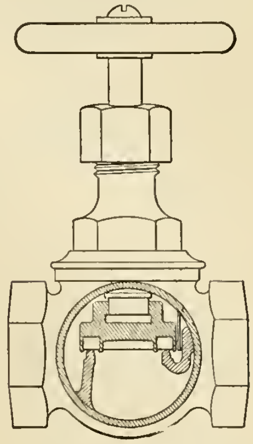


Fig. 5—Globe Valve.

Globe valves should never be placed in a horizontal steam or dry return pipe, because the condensation must fill the pipe half full before it can flow through the valve; this will be evident from an inspection of Fig. 5.

The blow-off pipe of a boiler is usually provided with a plug cock, and a gate valve is placed between it and the boiler as a safeguard in case of a leak. Special blow-off cocks are sometimes used in place of the ordinary plug cock and valve. Fig. 6 shows the Shaw blow-off cock. This is made very heavy and so designed that it is difficult for dirt or scale to lodge beneath the seat.

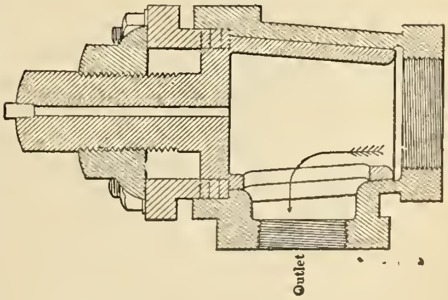


Fig. 6—Shaw Blow Off Valve.

When it is necessary that the flow of steam or water shall always take place in the same direction, check valves are used. There are several forms of this type of valve in use, the most common of which is shown in Fig. 7. The seat

in this valve is placed at an angle of about 45 degrees with the direction of the flow. The valve is fitted somewhat loosely where it is fastened to the swinging arm, so that it may properly seat itself. This form is usually preferred in heating work as it offers less resistance to the flow of steam or water, and by its construction offers but little opportunity for scale or sediment to lodge on the seat. When it is desired to reduce the resistance to a minimum, the check may be turned partially on its side, or a special aluminum clapper may be used.

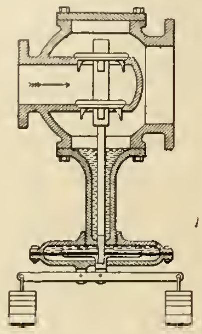


Fig. 8—Kiely Reducing Valve.

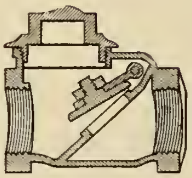


Fig. 7—Check Valve.

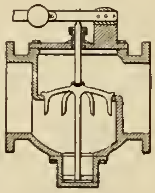


Fig. 10—Back Pressure Valve.

It is often necessary to provide steam at different pressures in the same building, as in the case of a combined power and heating plant. In this case, the reduction in pressure is accomplished by passing the steam through a reducing valve. There are many different forms of these valves, the operation of all being based upon the same general principles.

In the Kiely valve, shown in Fig. 8, the low-pressure steam acts upon the top of a flexible diaphragm, and the

Fig. 9—Watson Reducing Valve.

weighted lever, which may be adjusted to give the desired reduction in pressure, acts upon the other side. The movement of the diaphragm causes the balanced valve at the upper end of the spindle to open or close, as may be necessary to maintain the desired lower pressure. In the Watson valve, Fig. 9, the reduced pressure acts upon the lower end of a piston valve, having an adjustable spring at the top. As the piston simply passes through the inlet chamber, its action is not affected by the high-pressure steam surrounding it.

There are several good valves in use which embody the same principles, or a combination of the two. Those mentioned are among the simplest, and are, therefore, appropriate for purposes of exemplification.

A back-pressure valve is a form of relief valve which is placed in the exhaust pipe from an engine or pump to prevent the pressure in the heating system with which it connects from rising above a given point. Its function is opposite to that of the reducing valve, which supplies more steam when the pressure becomes too low. The form shown in Fig. 10 is for a horizontal pipe, and consists of a disc closing the port and held in place against the pressure by a weighted lever as shown. The pressure at which it is desired to have the valve open may be adjusted by moving the weight along the lever.—American Electrician.

THE WORLD'S PRODUCTION OF COPPER.

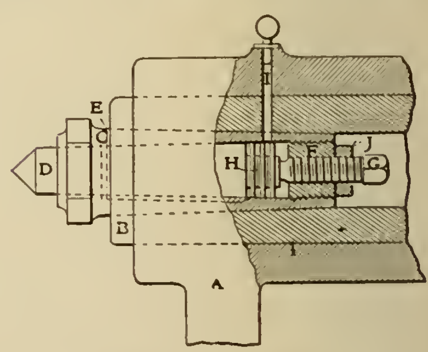
THE statistics here given show the progress in copper production during the past ten years. While they indicate a steady growth in the yearly output of copper, it is not yet certain whether this growth is keeping pace with the increase in consumption. For the year 1904 the aggregate output was 613,125 tons, in comparison with 574,740 tons for the preceding year; 541,255 tons for 1902; 479,514 tons for 1900; 399,730 tons for 1897, and 324,505 tons for 1894. The output has almost doubled in the past ten years. The better proportion of the 38,385 tons increase during the past year is traceable to the United States, which continue to furnish more than fifty per cent. of the world's copper. Australia made fair progress, putting out over 34,000 tons. Chili made but little increase, putting out about 31,000 tons. Japan shows an increase of about ten per cent., while Spain and Portugal show decreases. Mexico shows an increase of about ten per cent. Canada and Germany remain about the same. The outputs of the different sources of the United States were as follows: Montana, 110,500 tons; the Lake sources, 92,320 tons; Arizona, 81,750 tons; other states, 49,600 tons. Reports from Alaska and the other northern districts indicate that they may become important copper producers.—Engineering, London.

A HIGH-SPEED LATHE CENTRE.

THE illustration shows a lathe center, intended for lathes in which heavy shafting is turned. It is a well-known fact that tail centers—never too satisfactory—have, since the advent of high-speed tools, become a perfect nuisance, heating and binding in the work and often seizing and twisting off. This center is so designed that when the friction at the point becomes too great the center rotates in a bearing.

A is a section of the tailstock having the ordinary tail spindle B. The special center bushing C is tapered on the outside and fits in the tail spindle in the usual way. It has a tapered hole in it—larger at the back end—which acts as a bearing for the center D, which is fitted to it. The rear end of C is threaded and fitted into it is the externally and internally threaded bushing F. Into F is screwed the thrust-screw G, which has a nut J to keep it from getting out of adjustment.

Between the end of the thrust-screw G and the rear end of the center D are interposed the anti-friction disks H. These disks are alternately steel and bronze. Oiling is provided for through the oil holes E and I. In service the thrust-screw G is tightened up until the fric-



A High-[illegible] Centre.

tion between the center D and the bushing C is slightly greater than the normal friction between the center D and the work. So long as the friction between the center D and the work remains normal, the center D will remain stationary; but as soon as this friction

increases between that of D and C, then D will rotate in the sleeve C. In action the center D is alternately at rest and rotating.—American Machinist.

KEEP GOOD TOOLS.

THERE are few mechanics who realize the importance of keeping their tools in perfect order. Nevertheless, the experience of every one having to work with a set of tools ought to prove that he should love his tools and regard them with pride. We scarcely recollect a single instance of a really good workman who did not possess this affection for and pride in the implements which enabled him to turn out his work well.

If hammers are rusty and with faces covered with careless nicks, and fitted with ill shaped and broken handles ; if sharp-edged tools are badly ground and covered with rust ; if cold chisels are made very much like old shanks taken at random from the scrap pile, and litter, dirt, tools and fragments are clustered

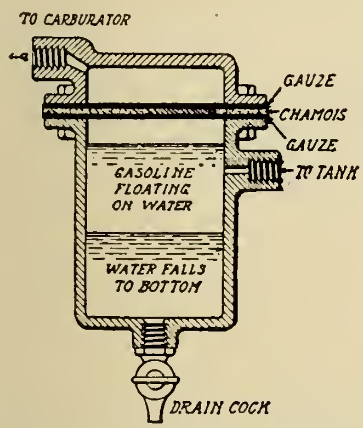


Fig. 1—To Separate Water and Gasoline.

together in a close conglomeration, it will convey about the same idea to the observer that a beggar in tattered habiliments would in the parlor of a prince. Every one would feel a great desire to either eject the intruder from the apartment or at once leave the place himself. There are instances where this affection for and pride in implements has gone extremely far and become almost a monomania—so much so that the journeyman could scarcely bear to see you examining his chisels, files, etc., and seemed to have a fear, while you were looking at them, of some outward effect like that which the Indians attribute to an evil eye, but which merely arose from a species of selfish affection for these children of his handicraft.

Every tool should have a place and be kept there when not in use. The amount of time saved in a year by having everything in order is astonishing. It often happens that when a job is to be done in a hurry there is more time wasted looking for tools than would be required to do the job. This does not pay, and besides the customer goes away in an unpleasant condition of mind, and will not be apt to take another job to that shop if he can help it ; but he will be almost glad of the opportunity of visiting the shop where work is done promptly and pleasantly. The people soon find out the best shop to deal at and the best shop gets the cream of the trade, while the old fogies growl and grumble while the dust is settling on them, which they are too lazy to shake off.

I have known men starting in business in towns where there did not seem a ghost of a chance for them to succeed, yet in a short time they were doing a prosperous business. They would never have done so if they had not done their work well and paid proper attention to their business ; or, in other words, they did everything in an orderly manner.

In some shops, cuttings of lumber are all mixed together in one pile, and much time is lost in looking for pieces of certain size. The result is that a whole board or piece is cut into just because they did not have time to look up pieces, when if the pieces had been handy they could have been used. In these days, when competition is sharp, it is very important to consider these things. There are many shops in this country that do not pay just because everything is done in such a disorderly manner.

There are steels and steels. Some of them act queerly. A planer man was much annoyed at the breaking of his cutting chisels every morning in the cold weather. He had become infatuated with a "high" steel that was worked at a low red heat and was not hardened for tempering,but was left to cool under the hammer. But his planer was near a basement wall, on which the frost has stood every cold morning during this "open" winter. Soon as he started a chip, away would go the point or edge of the tool. At last he put his thinking cap on, and, procuring a small alcohol lamp from a glue pot, he swung it on the crosshead saddle so that the blaze came up by the side of the tool. This heated the tool so that it was almost painful to feel it. He had no more snap breakages. After the tool got heated by the friction of its work the lamp was turned off. Another machinist, working on threading taps, heats up the threading tool in the morning by grinding it on an emery wheel.—National Builder.

SEPARATING WATER FROM GASOLINE.

FINE wire gauze will not remove water, but if a chamois skin pocket be carried by a gauze on either side and placed between the gasoline tank and the carbureter, all dirt and water will be removed. The arrangement should be on the order of the device shown in Fig. 1, so that the water may settle into a separator, and be drained off. The separator should be about 4 inches long and 2 inches in diameter. If this is drained each day no water will reach the carbureter unless the chamber becomes filled, which could only be occasioned by rain entering the fuel tank, as the gasoline itself of a day's usage would not contain that quantity. The strainer placed between the tank and the carbureter is better than one placed at the tank, for the reason that in the latter dirt and water would be forced through the tank strainers by the impact and weight of the fuel entering, while in a strainer placed between the tank and the carbureter the fuel is strained slowly, in fact as slowly as it is used. A first-class water separating strainer is shown in Fig. 2. At the bottom of the separating chamber is a needle valve. On this valve is a metallic float of such a weight as to sink in gasoline and just float in water. When

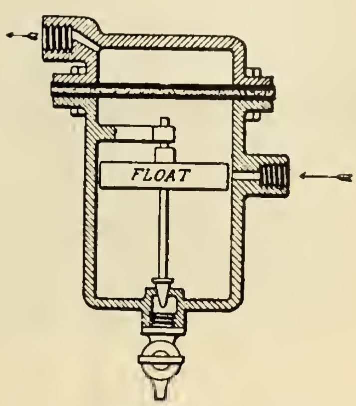


Fig. 2.

the chamber is filled with gasoline the valve is seated, but as soon as water collects the float is lifted, opening the valve and letting the water flow out until the gasoline comes to such a level as the valve seats. The device has the gauze and chamois strainer.—Motor Age.

CONTRACT AWARDED.

The contracts for the Regina water works and sewage extensions have been let to Messrs. Dobson, Jackson & Fry. The contract provides for the putting down of 11,400 feet of water mains and the same amount of sewage extensions, and the contract figure is in the neighborhood of $23,400. The council has decided to give a trial to wooden water pipes and the contract for the supply of the pipes required for the extensions has been awarded to the Canadian Pipe Company, of Vancouver, who have also secured the contract for valves, hydrants and valve boxes, the value of the company's contract being $6,600.

Electric Drive in Machine Shops

By J. C Armer

ELECTRIC drive for machine tools has received so much attention from manufacturers of late that it is scarcely necessary to enlarge on its many advantages at this time. The problem now in the equipment of a machine shop is not one of electrical or mechanical drive, but rather of the best system of electric drive under the existing circumstances. Nor does the consideration of electric drive now embrace merely the mounting of the motor upon the machine, but must take into account the question of economy and efficiency as exhibited in the different systems of direct drive.

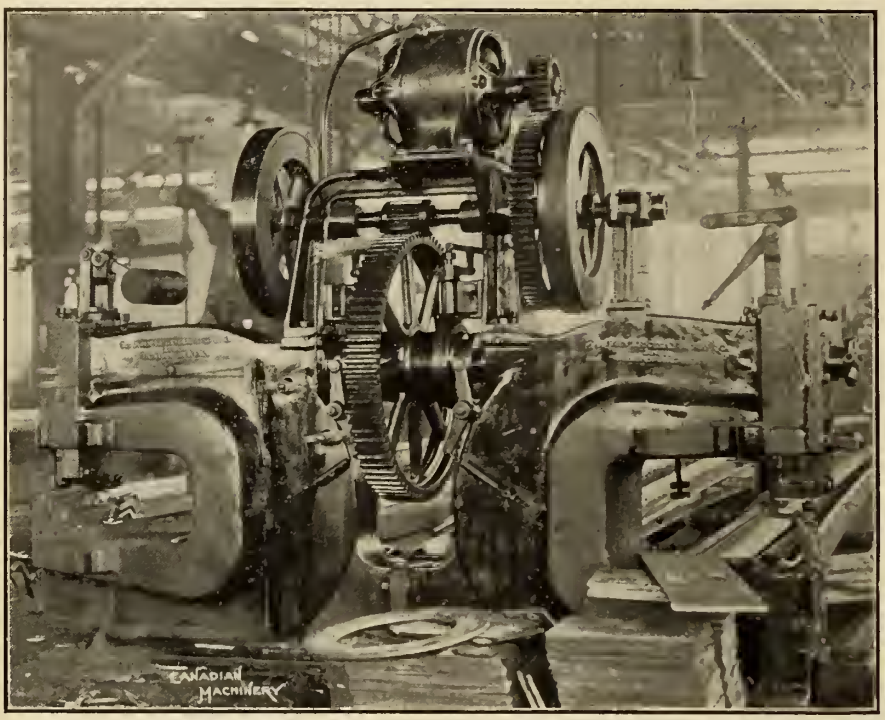


Fig. 1.

The Advantages of Electric Drive.

The advantages of electric drive are covered fairly well by the following facts: Saving of power because of the absence of long lines of shafting, which consume power whether the machines are running or not; greater facility of control than can be obtained by tight and loose pulley; the machine tools can be placed wherever most convenient without reference to a line of shafting, and can, if desired, be moved to different parts of the shop with a minimum amount of trouble; greater cleanliness and better lighting facilities occasioned by the absence of shafting and countershafting and the belting to each machine. These are probably the chief advantages, although there are others, counterbalanced, however, to some extent.

The saving of power and the more efficient control of the machines are the two advantages deserving of the most consideration. The per cent. of power saved depends upon the variation in the total machine shop load and upon the condition and arrangement of the shafting. In a machine shop between 25 and 80 per cent. of the total load is required to run the shafting. When running under half load the same per cent. of the total load is required, less the small amount occasioned by the decrease of friction in the bearings because of the lessened load. Thus the power required for shafting is always a per cent. of the total load, and only decreases by the amount of the frictional decrease as the load is lessened. In electric drive, on the other hand, the efficiency of each motor has only to be taken into account, and thus the lost power is a per cent. of the power being used, and not of the total load. Then, also, motor efficiency is high, varying from 70 to 90 per cent., as compared with that of shafting, varying from 20 to 75 per cent. The more efficient control allowed by the electric drive tends to better and cheaper production.

Individual and Group Drive.

The question of individual or group drive is an important one. It is in most cases a matter of specific calculation, although there are groups of small machines in a large machine shop the advisability of group drive for which is quite apparent. In small machine shops calculation is necessary in most cases as to whether it would pay to install electric drive, but in making this calculation care should be taken to include all considerations. Some of the important factors would be the relative cost and efficiency of small and large motors, the amount of time each machine stands idle, the mechanical efficiency of the shafting, and the relative efficiency of electrical and mechanical drive, the last of which cannot be computed in figures exactly, but should nevertheless have proper consideration.

Modern Shops Electrically Equipped.

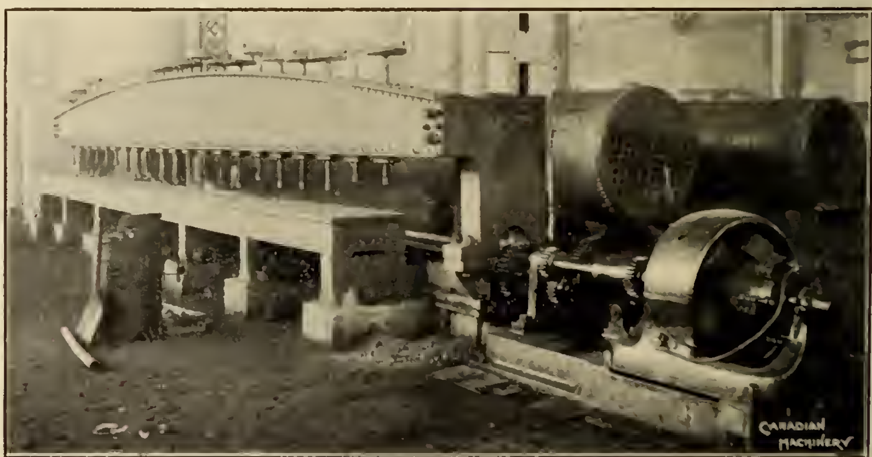


Fig. 2.

The machine tool equipment of all large modern machine shops shows clearly that the advantages of electric drive, individual or in group, are not mere theories but proven facts. All the

latest large Canadian machine shops are electrically equipped, among them being the machine shop at the Canada Foundry, Davenport; the machine shop of the Locomotive Machine Co., of Montreal, Limited, Montreal; that of the Canada Car Co., Montreal; that of the Canadian Westinghouse Co., Limited, Hamilton, and that of the C.P.R. shops in Montreal. Many older machine shops are also equipped with electric drive, and there are very few of the large Canadian shops where one or more of the largest machines are not motor driven.

Systems of Electric Drive.

There are several systems of electric drive by both direct and alternating current, and there are also combination systems of the two, direct current series wound motors being used for variable speed work and induction motors for constant speed work. The first attempts at electric drive were with shunt-wound motors, the machines being driven in groups. This, however, soon developed into direct drive by series motors, change of speed being obtained by varying the resistance in the circuit with a rheostat. This is a wasteful method of control, and has been displaced by the various systems of multi-voltage control. The simplest of these methods is the three-wire system, by which two speeds can be obtained without a rheostat, and with a rheostat and controller combined a speed range of 4 to 1 can be had.

All the systems of multi-voltage control consist of a number of circuits operated at different voltages, and the chief objection to them is the complication of the generating apparatus and the wiring. This is the reason many machine tools have been equipped with constant speed motors, change of speed for the tool being obtained mechanically by means of cone pulleys or gearing. The three-phase induction motor is the best for constant speed work of that kind, because of its simplicity and reliability. Thus in an electrical equipment a combination of alternating and direct current is very often used, direct current being used where variable speed motors are necessary.

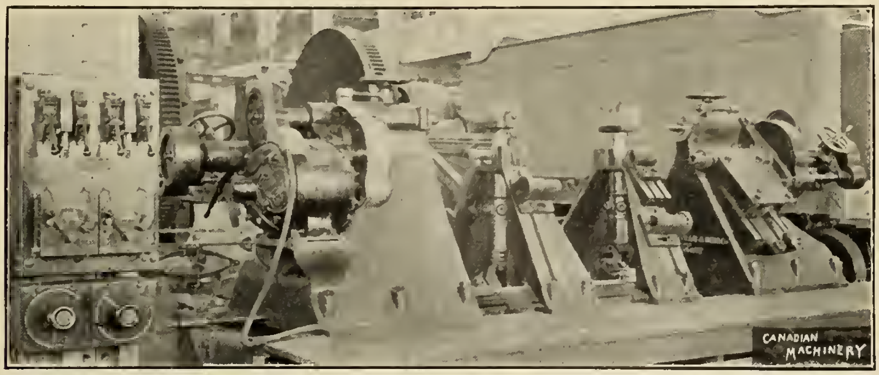


Fig. 4.

Such an installation there is at the Hamilton Bridge Works, Hamilton, alternating current being obtained from the Cataract Power Co. All the machine tools, shears and punches, bolt and rivet machines, etc., are driven singly or in groups by constant speed induction motors, while the traveling cranes are equipped with D.C. variable speed motors, the direct current being supplied by a motor generator set. Here the speed changes for the tools is obtained by cone pulleys.

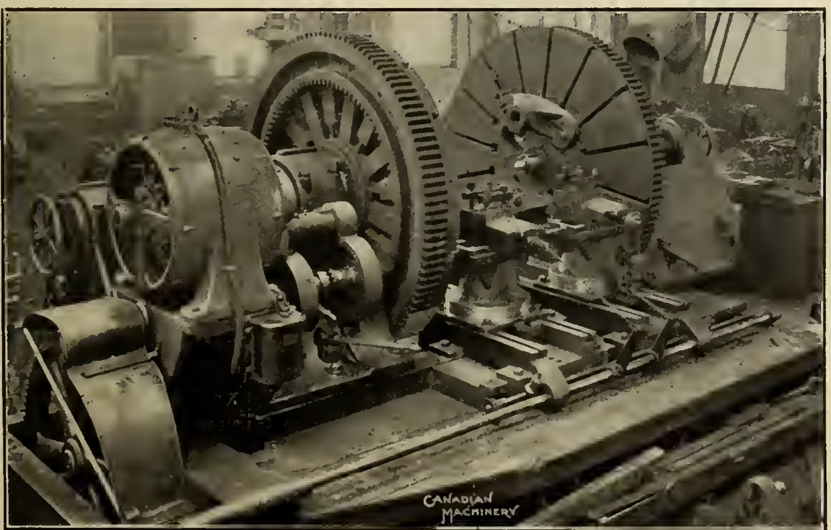


Fig. 3.

Two years ago a very interesting electrical equipment was established in the shops of the Great Northern Railway at St. Paul. To avoid the complications of a combination system of drive, and to secure the advantages of the induction motor for constant speed work alternating current motors were established throughout for variable as well as constant speed work. To use induction motors for variable speed drives at that time was contrary to existing practice, but the system has been thoroughly tested during the past two years, and the management of the motive department claim that it is the best they could have installed. The induction motors used for variable speeds are single phase, and the speed variations are obtained by varying the resistance in the secondary circuits. In these shops the cranes, transfer table, wheel lathes and several other machines, are equipped with variable speed induction motors. The first cost of an induction motor equipment is much more than that of a direct current. Induction motors, however, require less attention and will withstand much harder usage than direct current motors, and thus the cost of repairs is very much less. Although the full load efficiency of a D.C. motor is greater than that of an induction motor, the latter has a greater starting torgue and a much greater overload capacity. Considering the inconvenience and indirect cost of a motor breakdown, the reliability of the induction motor under severe service was the deciding factor in the choice between the two systems in this case.

The Niles-Bement-Pond Co. have recently placed on the market a lathe the speed change for which is a combination of motor speed change and change by gearing. This necessitated a complete departure from the usual form of headstock construction. By means of gearing six speed changes can be had at the face plate, which, when combined with the speed range of 2 to 1 in the motor, gives a speed range of 12 to 1.

F. J. Parkin, who was the electrical engineer in charge of the installation at the Davenport works of the Canada Foundry, has made quite an exhaustive test, during the first four or five months of this year, of the electric-driven tools in the shops. These are Bertram tools driven by Canadian General Electric mo-

tors. There are installed throughout the shops 150 motors ranging from 2 h.p. to 50 h.p., the total capacity being 2,066 h.p. The three-wire system of distribution is used on the machine shop and boiler shop, where variable speed D.C. motors are installed, and a voltage of 230 is provided in the other shops, where constant speed motors are installed. There is a marble switchboard in each shop, and each motor is provided with a slate panel on which is mounted the rheostat and circuit breaker. The results of the tests on several of the machines are as follows :

Reaming machine : 15-16 inch holes for ⅞-inch rivets through 2-inch plates ; motor C.E., 4-7½ h.p , 815 R.P.M.—No. 01499.

Starting swing—215 V.—35 amp. 10.8 h.p.

Light running load—215 V.—	12 amp.	=	3.4 h.p.
Reamer No. 1— "	20 "	=	5 7 "
" " 2— "	·0 "	=	5.7 "
" 1 and 2— "	35 "	=	10.8 "

Plate edge planer ; speed of plane, 22 ft. per minute ; cutting ½-inch plate ; motor M.P. 4 20 h.p.—230 V., 680 R.P.M.

Starting swing—220 V.—70 amp.=20.6 h.p.

Light running load—220 V.—15 amp.=4.0 h.p.
" " " with head, 20 amp.=6.0 h.p.

Cutting ½-inch plate 220 V, 25 to 28 amp.=7.9 h.p.

Reversing west end, 220 V., 50 amp.=14.7 h.p.
" east " " " 45 " =13.3 "

Punch and shear ; 69 strokes per minute ; motor C.E. 4-7½ h.p.=815 R.P.M.

Shearing 3-16-in. plate, 4 h.p.
" ¼-in. " 5 "
" ½-in. " 6 "
Punching ¾-in. hole, 7 "

Shearing ¾-in. plate and punching ¾-in. plate ¾-in. hole, 17 h.p.

Planer, 84 in.; cutting speed, 23 ft. per minute, two tools taking ½ in. cut in cast iron.

Light running load..	220V.	30 40 amp.	=11.8 h p.
Cutting motion.....	"	65-95 "	=26.5 "
Reversing motion..	"	160-170 "	=50 "
Return motion.....	"	50-75 "	=20.6 "
Reversing to forw'd.	"	140-145 "	=42.7 "

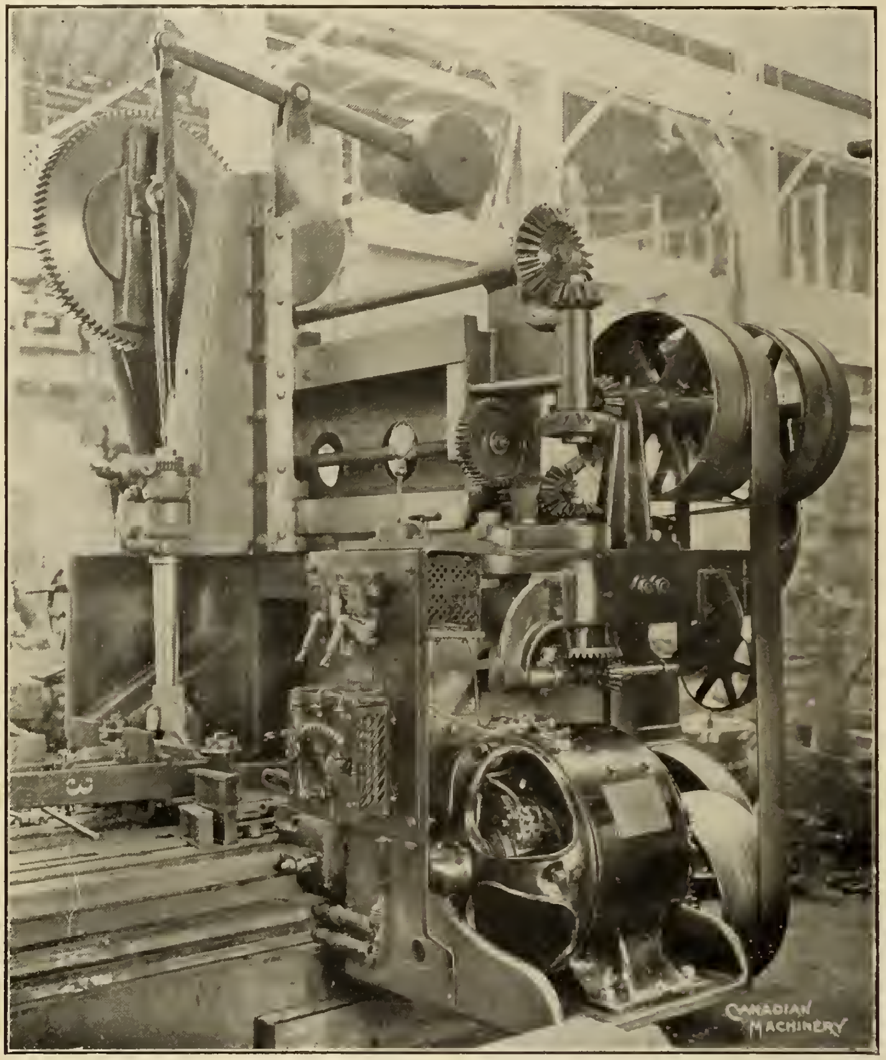


Fig. 5.

Double-headed drill, drilling 5 15-16 holes ; motor, C.E. 2-2 h,p., 1,100 R.P.M ; travel 2 in. in 17 min.

Starting swing....	215V.	14 amp.	= 4.03 h.p.
Light running load	"	6 "	=1.6 "
Working load, slow speed..........	"	7½ to 9 amp.	=2.3 "
Working load, fast speed..........	"	12 to 15 "	=4.3 "

Figure 1 is the punch and shear tested. It is a Bertram tool. Figure 2 is the plate edge planer tested. Figures 3, 4 and 5 are other tools, manufactured by John Bertram & Sons, Limited, in the machine shop equipped with Canadian General Electric D.C. variable speed motors.

PERSONAL MENTION.

Mr. Archibald Glassco has been appointed as bridge engineer of the Grand Trunk Pacific Railway. Mr. Glassco is a native of Hamilton, Ontario, but has been for the last few years in the employ of the Dominion Bridge-building Co., Montreal. He is a science graduate of McGill. In his new position Mr. Glassco will have his headquarters at Montreal.

Mr. John Burns, the English labor leader and member of Parliament, is now in Canada on his first trip to this country. He is accompanied by Mr. J. Allen Baker, the Canadian who a few months ago inflicted a decisive defeat on a Chamberlainite candidate in East Finsbury. The mission of Mr. Burns to Canada is merely to see the country and study labor conditions as they exist here.

A noted Canadian machinist and inventor, in the person of Mr. Chas. Taylor, passed away on Friday, Aug. 25th, at his residence, 132 Field street, Montreal, at the age of 89. He was born at Sheffield, Sunbury county, Md., and learned the trade of engineer and millwright. His mechanical abilities were soon recognized and he set out to work on various inventions, with a view to improving the machinery used in the Nova Scotian gold mines. Through his genius the first stamp mill in the Lower Provinces was erected at Waverly, Halifax county. He also invented the first stone crusher used in connection with the Nova Scotian mines. He also enjoyed the distinction of being the first man to cross the Miramichi River in a steam craft. During his day he was associated with many of the most prominent men in the country. In 1875 he came to Montreal, where he has since resided, continuing in his trade and always interested in inventions.

SMOKE TURNED INTO GAS.

A novel method of getting rid of black smoke, and at the same time turning it to use, is adopted at some Belgian factories. The smoke is driven by fans into a porous receptacle, over which flows a stream of petroleum or similar liquid. The smoke is thus caught and turned into gas that gives great heat, and can be used for running gas engines.

NEW ROLLING MILLS FOR QUEBEC.

Rumors are afloat in Montreal, that an American firm is considering the establishment of rolling mills, in the province, probably in Quebec City. Color is given to these reports by the fact that several prominent metal men in Montreal were interviewed last week by gentlemen representing large American interests.

(*Continued from page 348.*)

exhibit consists of a large tank above which is situated a filter press in active operation. Water is pumped by means of a rotary pump from the tank into the filter from whence it descends to the tank to be used over again. This filter is adaptable to any liquid that may be pumped through a rotary pump. The pump works at 100 lbs. pressure and is provided with a safety attachment, governing an overflow cock, through which all excess liquid passes. In the rear of the stand is situated a filter press operated by hand power. It is used for pressing fruit, cider, herbs and for general purposes. It weighs complete 1,500 lbs. and has a working pressure of 20 tons. Another feature is a triple plunger pump, with eccentrics and driving pulley. It is built for very heavy work and will maintain a pressure of 5,000 lbs. The pump valves and journal boxes are built of solid brass and the plungers are made of steel. A pretty souvenir was given away, being in the form of a medal, stamped by one of their hydraulic die presses, a greater interest being attached to it on account of the fact that the sample was done while the visitors watched the operation. To do this one of their hydraulic die presses was used. The latter are for making dies, carbons, etc., as well as for crimping and embossing leather or sheet metal goods. It operates at 75 tons pressure and is fitted with single hand pump and water box attached to the press.

Brass and Electrical Goods.

Sparkling with brilliance from hundreds of lights in beautiful brackets, chandeliers and lamps, the exhibit of the James Morrison Brass Manufacturing Co., Limited, was one of the most striking in any of the buildings and certainly the centre of attraction in Machinery Hall. Three classes of goods were shown, one end being devoted to plumbing goods, the other to brass goods and engineers' supplies, the walls and ceilings being used to show to advantage the beautiful electrical, gas and combination light fixtures manufactured by the company's experts. The collection was most complete and the various designs represented the latest creations. Special attention was given to the array of dining-room fixtures, while lights for drawing rooms, halls, dens, etc., were also shown. The house fixtures were shown in bush brass, antique brass, copper, oxydized and gold lacquered finish and the lights enclosed in bulbs and various shapes of art colored glass, the color effect and design being in advance of anything heretofore shown. Some newel post and table lamps in the form of bronze figures were particularly attractive. The most beautiful of all, however, was a running fountain for the conservatory, its design being very original, five small colored bulbs diffusing their rays through the running water.

Besides a very complete line of plumbing goods of all kinds, the engineering supplies occupied considerable space. Amongst these several large tiers of J. M. T. gate, angle and globe valves were conspicuous. They included all sizes from $\frac{1}{8}$ to 4 inches. Near these were piles of Hancock inspirators and J. M. T. injectors, from $\frac{1}{4}$ to 3 inches. A line of steam vacuum and pressure gauges was arranged on the wall in the form of a crescent, the light from the numerous incandescent lamps showing these up to advantage. Grease and oil cups, both glass and brass shell, in all sizes were arranged in brackets on the wall. There

Jones & Moore Exhibit.

The exhibit of the Jones & Moore Electric Co. was a scene of continual activity. The artistic lighting arrangement and the continual running of several of the machines, besides the handsome well lighted switchboard, all combined to catch the eye of the sightseer, and thus the exhibit was an attraction to more than those directly interested in electrical machinery.

The large and imposing sign of the company was outlined with numerous colored incandescent lamps and the exhibit itself was artistically decorated with them. The line of Adams-Bagnall arc lamps surrounding the exhibit on a

Canadian National Exhibition—The James Morrison Brass Manf'g. Co.'s Brilliant Exhibit.

were also steam whistles ranging from 1 inch up to 14 inches, the penetrating powers of which will be remembered by those who heard the one installed in the main doorway. Besides these were numerous fire protection supplies, including Siamese connections and hose nozzles, as well as pulp mill valves from 2 inches to 6 inches, safety valves, gate valves, water relief valves, twin valves for steam hoist, locomotive and steamboat valves from 7 to 24 inches, ship's binnacles and compasses, as well as many other lines.

From the wall at the back was hung an oak panel containing a complete set of gauges with clock for a boiler equipment, including vacuum, pressure and compression gauge, water, sprinkler and steam gauge. This panel was designed for George S. Wright, engineer, Toronto.

110 volt circuit increased the brightness of the exhibit.

In all there were 11 machines on exhibit including D.C. dynamos and motors and induction motors. Two D.C. generators of 50 and 30 k.w. capacity respectively were running, supplying the power for the lighting of the exhibit itself, also the Fairbanks exhibit, James Morrison brass exhibit and the signs on the Machinery Hall. Several of the other machines were running as motors, and one could not help noticeing how smoothly these were running. In fact as far as noise and vibration were concerned, one could scarcely tell that the armature was moving. This firm build D.C. machines of the multi-pole and two

pole types and also induction motors for all phases and voltages.

They make quite a specialty of switchboard construction, and the three-panel board shown in the exhibit was an example of the handsome and well equipped boards installed by them. Two of the boards were equipped with measuring instruments of their own manufacture, while the other was equipped with those of the Wagner Electric Mfg. Co. The equipment of the boards included measuring instruments, rheostats, switches, circuit-breakers, automatic and hand, and fuses of all kinds.

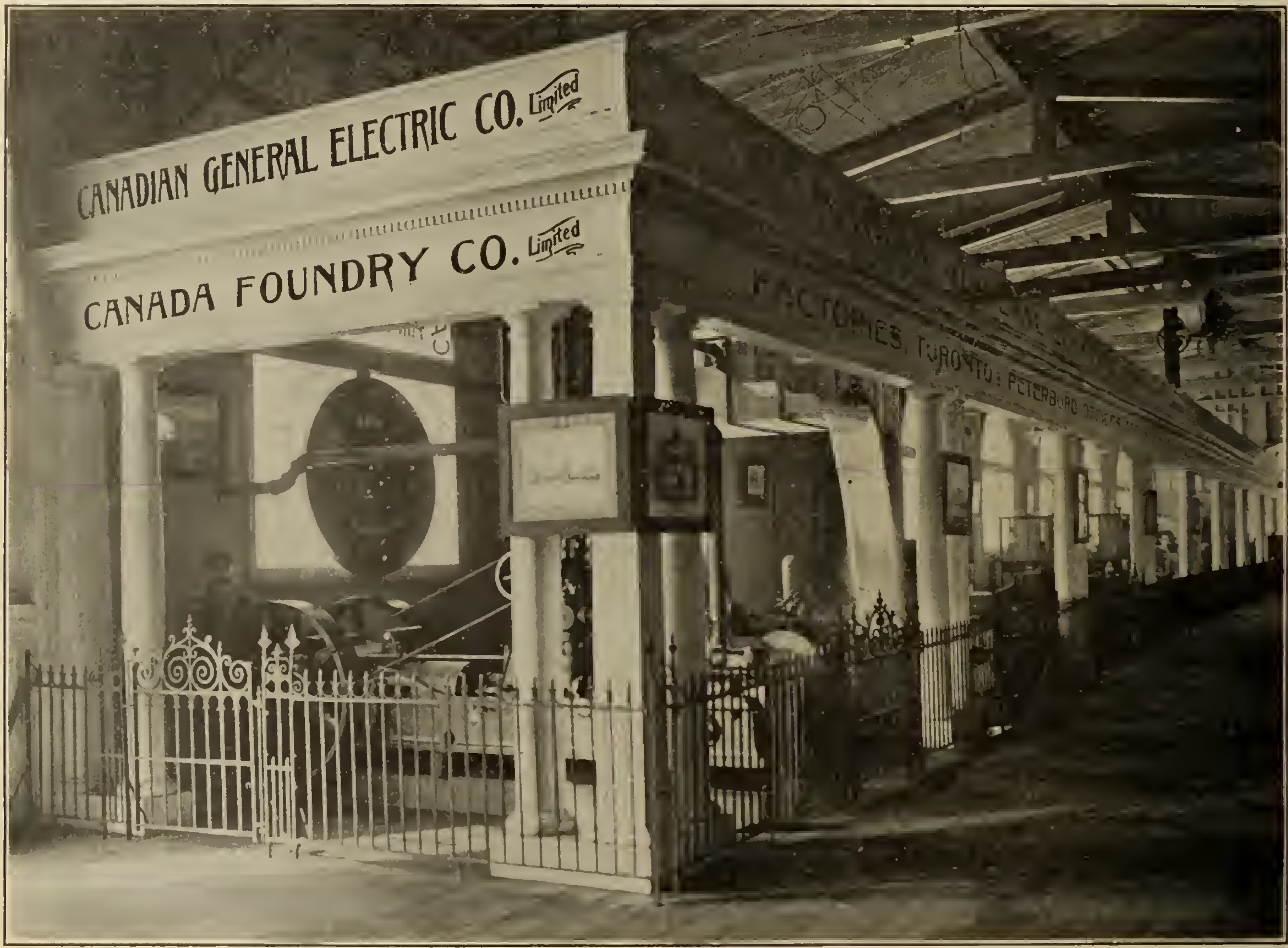
The display board of electric supplies of all kinds demonstrated that the company pay considerable attention to house and factory wiring and also the installation of private phones. The supplies displayed on the board included push buttons, fuse boxes, switches, bells, battery supplies and lighting fixtures.

This firm has been and is growing steadily. Very recently they moved into their new factory with a capacity of double the former, and now they are beginning to extend their business in the west. Mr. Jones is at present in Winnipeg looking after the establishment of a branch business and probably very soon the company will be exploiting the western as they have done the Ontario market.

Canada Foundry Co.

One of the largest as well as one of the most interesting exhibits in the Machinery Hall was that of the Canada Foundry Co., Limited, who made a creditable display of many of their lines of manufacture. The first article to attract attention was one of their Canada Air Compressors shown in operation. This machine is a 10 and 10 x 12 straight line compressor, capable of compressing 175 cubic feet of free air per minute to 100 lbs. working air pressure. This was connected to an air receiver outside, to which was attached a melodious whistle. Next appeared a hoisting engine, complete with steam boiler. This hoist is a radical departure in design, and was equipped with two independent hoisting drums capable of lifting 8,000 pounds. Each is arranged with friction brake and pawls equipped with ball bearing thrust, operating in a dust proof oil bath. Each drum is self-oiling, having an oil chamber capable of containing enough oil for a year's operation. The drums are put in operation by means of levers attached to double cone frictions and are checked by differential brake bands adjusted at the top, supported clear of the drum barrel when not in use. All the levers to operate the drums and brakes are arranged to operate from one point convenient to the throttle. In addition there are four independent winch heads connected to the drum shafts by levers and jaw clutches. The upright boiler can be cleaned from the top without removing the hood, the whole equipment being compact and convenient to operate.

A miniature Niagara cascade was the next to attract attention, this was fed by a 6 x 5 x 7 duplex steam tank pump. Near by was a drinking fountain, which was much in demand throughout the Fair.



Canadian National Exhibition—Exhibit of The Canada Foundry Co., Limited, Toronto.

An assortment of centrifugal pumps of all sizes was also shown.

The office was surrounded by neat fences of different designs and at the rear was a massive driveway gate for the St. James' cemetery. A white enamel fountain in the centre gave an idea of coolness which was not otherwise noticeable. Next appeared a teller's cage of ornate design finished in oxidized brass with many samples of intricate design of hand-hammered iron work. A locomotive boiler then loomed up, surrounded by samples of massive steel flangings, formed in one heat on the largest flanging press in Canada, which is installed in the Davenport Works of the Canada Foundry Co.

A complete line of steam and power pumps was shown from the smallest duplex steam pump to the massive 1,500 steam and triplex power pumps, and jet gallon underwriters' pump, also single air condensers. The whole exhibit was enclosed with gates at convenient places.

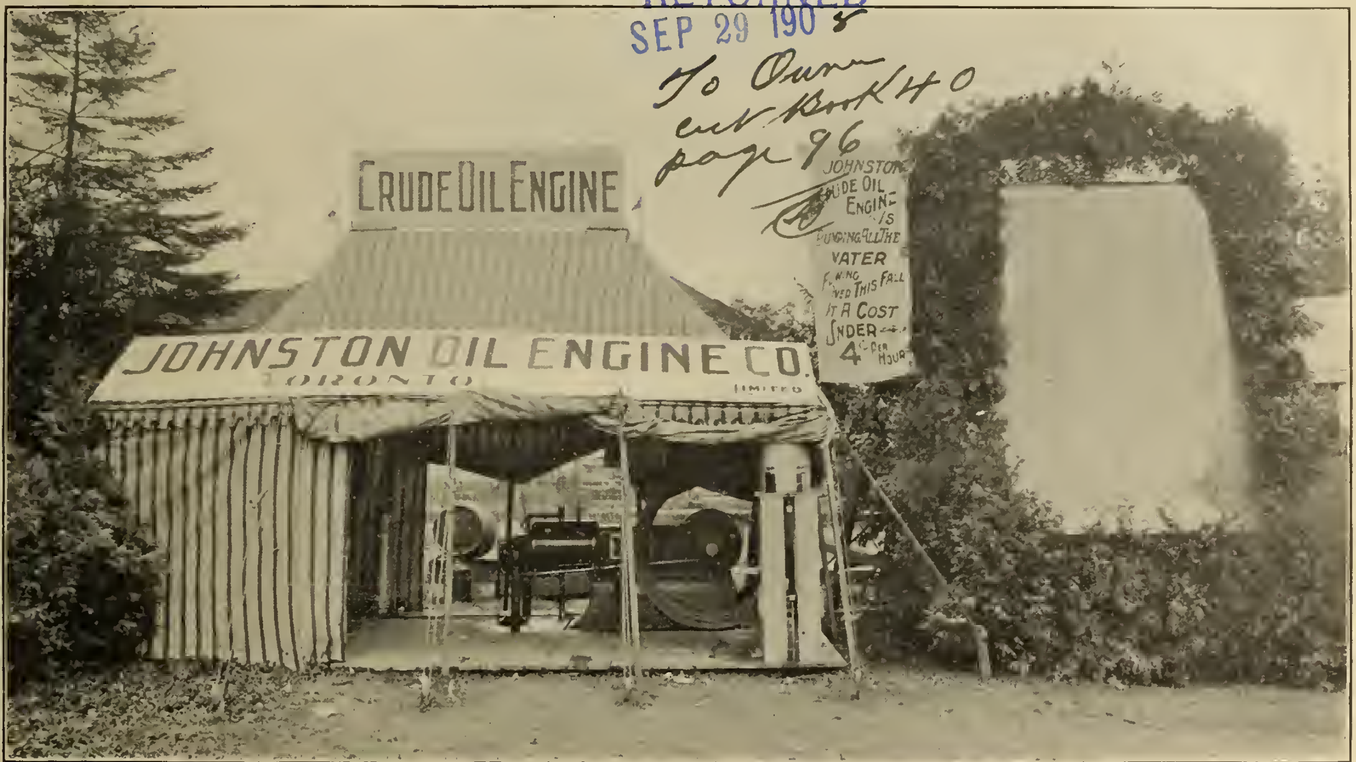
Not the least interesting feature of this exhibit was a large number of enlarged photographs showing views of the different shops and machines made in them.

Johnston Oil Engine Co.

Probably no exhibit at the Exhibition attracted more universal attention than that of the Johnston Oil Engine Co., where a miniature waterfall, emptying through a cedar arch, attracts the visitor from all sides. The motive power for this is supplied by one of the company's 10 h.p. crude oil engines running a centrifugal pump of 7 inch discharge, which pumps 500,000 gallons per day. The situation is immediately in front of the Process Building, near the Machinery and Electrical Hall, and occupies a splendid point of vantage. Apart from the general attractiveness of the exhibit, which consists of a tent for housing the engine, besides the pump and waterfall mentioned, the prime mover itself is worthy of more than passing notice. The principal feature of the engine, looked at from a commercial point of view, is the use of any liquid fuel in this engine, cheap unrefined oil serving the purpose, and with such the engine was operated during the Fair. The principle of this engine is somewhat different to that of the ordinary combustion engine, as no attempt is made to convert the oil into gas before it enters the cylinder, nor to produce an explosive mixture. The oil is simply injected into the cylinder, where the air has already been compressed, in the form of a fine spray, where it strikes against a red-hot plate located on the end of the piston and is immediately ignited and burned. The heat developed by this combustion, raises the temperature and hence the pressure of the contained air and products of combustion. The rise and pressure is directly proportional to the amount of oil consumed and under full load the pressure rises to 300 lbs. per square inch, while the compression pressure is kept constant under all loads at 150 lbs. per square inch. The oil consumption is approximately 1-10 of a gallon per h.p. per hour. As any oil will serve the purpose, the cheapest is employed. That used in the exhibit is delivered on the grounds at 6 cents a gallon, thus making the cost per h.p. only 6 cents for ten hours. Where large quantities will be required, this cost could be reduced to somewhere in the neighborhood of three cents.

For a more complete description of this engine and an illustration of the same, readers are referred to the Power and Transmission Department of this issue.

To Own cut Book 40 page 96



Canadian National Exhibition—Johnston Oil Engine Co.

Georgian Bay Engineering Works, Midland.

When the Exhibition started, owing to the stress of other business matters, the Georgian Bay Engineering Works were not ready with their exhibit, and while showing two of their gasoline engines, their full proposed exhibit was to have included automatic pile drivers, hoisting engines, mine hoists and gasoline launches. They are doing an extensive business in the Cobalt district where, besides mining machinery, launches are required to tow the ore to the landing. The engines exhibited include one 4-horse-power and

one 2-horse-power of the Midland type. The extreme simplicity of the engine is a notable feature, as they have been designed with a view to fewness of parts. A magneto is used to supply the electric

Canadian National Exhibition—The Chapman Double Ball-Bearing Exhibit.

spark for ignition, thus doing away with the annoyance often due to batteries.

Chapman Double Ball Bearings.

The economical transmission of power is a problem that has troubled power users from the beginning, and the keen competition in manufacturing and transportation at the present time makes the question a live one. During the two weeks of the Exhibition those in charge of the exhibit of the Chapman Double Ball Bearing Co., Limited, Toronto, were continually demonstrating the effectiveness of their bearings in the solution of this problem. Besides the exhibit itself, the demonstrators had the shafting in the Machinery Hall, which is equipped with Chapman bearings, to refer to. This was a practical demonstration of the work these bearings would do without the least sign of heating, and that without any lubricating. The exhibit itself consisted of some counter shafting and pulleys equipped with the bearings which was being run from the line shafting above by means of a thread, and also a framework from which were hung sets of hangers, some equipped with Chapman bearings and some with ordinary babbit metal bearings, with which the power required to turn shafting in the two bearings could be compared. To enable those interested to study the construction of the bearing, the several styles of journal boxes containing the cages and balls were exhibited.

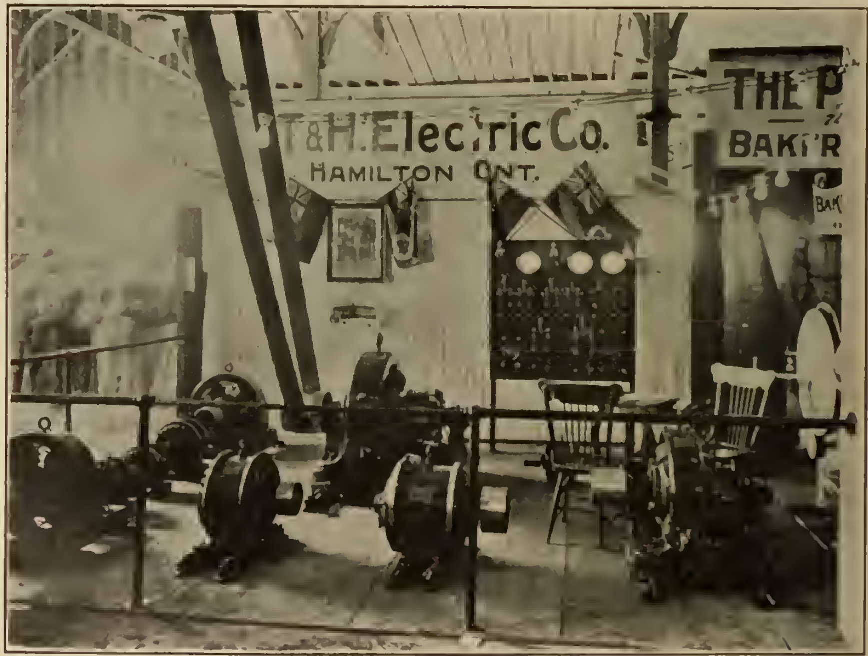
Ball-bearings in the past have been condemned, and rightly, but the failure of ball bearings was due to improper design. Mr. Chapman was the first to demonstrate that the load carrying balls in the bearing must be comparatively large. He further increased the effectiveness of the bearing by placing small balls in between the large ones, thus giving all the load carrying balls positive motion. The efficiency of this bearing has been proved under severe tests by competent men, and the numerous testimonials received by the company from users throughout Canada speaks excellently for the bearing in actual service. One of the best features of the ball-bearing is the effectiveness with which it can take care of the end thrust, and this is no small consideration.

The bearing itself consists of a cage containing the load-carrying balls, which are held a certain distance apart by compartments in the cage. Between each two of the large balls is a small contact ball which gives positive motion to the large ones. This is an important feature in the elimination of friction.

Toronto and Hamilton Electric Co.

Very neat and attractive indeed was the exhibit of the Toronto and Hamilton Electric Co., Hamilton, in the east end of the Machinery Hall. The exhibit consisted of D.C. dynamos and motors and single and two-phase induction motors, besides a two-panel switchboard. Running with remarkable smoothness was a 35 k.w. D.C. generator belted to the line shafting on the north side of the building, and supplying the power for the lighting of the exhibit.

It is the multi-pole type of D.C. machines that are manufactured by this company. The frames are cast from highly magnetic iron, soft and close grained. The pole pieces are of char-



Canadian National Exhibition—T & H Electric Company, Hamilton.

coal wrought iron, cast welded into the frame. The field coils are wound on metallic spools cylindrical in form. These spools slide over the pole pieces and are held in place by well designed

pole shoes. The armature is the iron-clad or toothed type in which the conductors are embedded in slots in the core of the armature. The armature coils are form wound. The commutator is built of hammered copper with mica insulation throughout. The company build machines of 3 k.w. capacity and upon this style. In addition to the 35 k.w. machine there were shown a 10 k.w., 7 1-2 k.w. and a 6 k.w. machines.

Of induction motors there were on exhibit one 12 h.p., two 8 h.p., one 3 h.p. and one 2 h.p. of the two-phase type, besides two 1 h.p. and one 1-2 h.p. of the single-phase type. The firm say that there is an ever increasing demand for induction motors, and the sale of them recently has been large.

The switchboard shown was a two panel slate board fitted with S.E.I. Electric Co.'s measuring instruments. The Toronto and Hamilton Electric Co. do not make any of the measuring instruments used on switchboards, but they do install switchboards as required.

This firm have placed great stress upon the correct theoretical and mechanical design of their machines and also the construction and from the appearance of the machines on exhibit it might well be surmised that they had obtained considerable success along this line.

Because of printers' delays the company had very little descriptive literature at the Exhibition, but the matter is now in the hands of the printers, and any one interested may secure bulletins upon application to the company.

Canadian National Exhibition—Intercolonial Railway Exhibit.

Canadian Bearings, Limited.

Situated near the south-east corner of the hall, a large Japanese canopy parasol, encircled with colored lights and continuously revolving, attracted the visitors towards the exhibit of Canadian Bearings, Limited, where the bearing invented by Mr. W. Hamilton Wright of Buffalo and being manufactured in Canada by this firm, was shown. The bearing itself is essentially different from any other roller bearing on the market, being designed to entirely absorb the end thrust. Another feature claimed for this bearing is the fact that no cage is used, which is conducive to longer life in the bearing. Other features are its taper-shaped rollers, a full description of which will appear in the Power and Transmission Department of this paper at a later date. While the company manufacturing in Canada has but recently been established, the invention is not new and has already been put to severe test, enough to demonstrate beyond the shadow of a doubt the efficiency of these bearings.

CANADIAN

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Vol. I. SEPTEMBER, 1005. No. 9.

"FORWARD IS THE WORD."

EVEN a passing glance at the cover of this month's issue of Canadian Machinery reveals the artistic effect, and a close scrutiny will show the artist's conception as realized in the design. While the name is prominent, the whole effect lends itself towards bringing forward the central figure, at whose left the picture panel typifies manufacture and industry. He is a man of brawn and muscle, as yet at the bottom of the ladder of progress, but withal resolute and determined. He hears ambition's call to press forward, and is about to take the step that will lead to the culmination of his present dream—that of becoming a master workman instead of a haphazard laborer of whom nothing is expected. He is typical of the present-day trend of thought, when men are not satisfied with conditions as they find them, but seek self-improvement, and in so doing benefit not only themselves but uplift the standard of mankind.

THE LAND OF GOLD.

WITH a golden harvest in the west ready for the reaping, golden prospects in every line of manufacture, winning golden opinions abroad as to her wonderful resources, whether of farm or forest, river or mine, surely this Canada of ours must be that land of promise, known in fable only to the ancients, where there would be peace and plenty and abundance for both man and beast. This much despised country of snow and ice, stunted pine trees and famished wolves, has come out from the shadow of ignorance and prejudice under which she has been unwillingly held by other people, and has emerged into the glorious sunlight of her own possibilities. The cry of the word gold from some inaccessible district where the metal is to be found has set the nerves of men tingling with excitement. They have forsaken wife and family, home and kindred and all attendant comforts, endured untold privations, famine itself, and dangers without end, all in the hope of gathering in a share of the yellow metal. This happened so recently as to be still fresh in the memories of all, and yet these very men in getting to the Yukon passed through a country where more gold awaited them than has up to the present been found in the richest mining discovery known to man. In the best year that the Klondyke has seen much less gold was produced than will this Fall pour into the pockets of the fortunate farmers of the west. Fifty million dollars is the conservative estimate placed upon the value of the wheat crop alone now being harvested, and this to be divided, comparatively speaking, among a small number. Why does humanity allow men to live in misery and squalor and want in the slums and hovels of great cities, when they might be independent and happy and enjoy the sunshine and gladness of our unspeakably great and incomparably golden western land ?

No less an authority than the New York Wall Street Journal predicts that the centre of the next great world movement will be in Canada, a prime agent in connection with which will be the new transcontinental railway with termini on the shores of the Atlantic and Pacific Oceans. When the cost is considered, which is estimated anywhere from $150,000,000 to $200,000,000, it must be realized that the spending of that amount alone will mean much in the next five years in Canada. Aside altogether from benefits which its construction will bring to Canada, through the opening of an entirely virgin territory to settlement and production, the mere fact that such an enormous sum of money is to be expended in the country, largely in the shape of wages and for supplies which will be of home production, is a sufficient guarantee of great general prosperity during the period of building at least. But when it is considered that the present wheat-producing capacity of the Canadian west is only two per cent. of the equally good growing land which will be thrown open to cultivation by the construction of this great national undertaking, the possibilities are simply staggering. It means that within ten years the production of wheat in Canada will be limited only by the ability to find the labor to cultivate the land and handle the crops. This development means a coming economic change which must be taken into consideration as a world's factor. Canada is now producing about one-sixth of the wheat raised in North America. Her new facilities will increase her ability so vastly that it is evident that she will before many years control the grain markets of the world, and in that fact there is much food for thought for the agriculturist of the United States.

Only second in importance to her wheat production, if indeed it long remains second, will be the return promised from the forests and mines, now practically inaccessible, but to be opened to the world with the completion of the Grand Trunk Pacific Railway. So far we have referred only to the building of the main line of something less than 4,000 miles, but it is the purpose of the Government of the Dominion to build innumerable branches, so that the most remote parts of the main line will be brought into touch with the existing railroads not only of Canada, but of the United States. One of these lines is al-

ready under construction—from Toronto to Lake Temiskaming, about 300 miles north in a straight line from the city on Lake Ontario.

Everything indicates that Canada is full of mineral—the precious metals, coal, iron, copper, tin, nickel, phosphates, and, in fact, everything that the requirements of the world demand abound, to say nothing of oil. These fields are thus far untouched. How valuable they are may be gathered from one accidental find on the Temiskaming Railway at Cobalt. Granting that there may be exaggeration about the glowing reports from this district, it must be admitted that sufficient has been shown to raise the hopes of Canadians that this hitherto unexplored country may prove an Eldorado. At least enough has been found to justify scientific search for precious and other metals, and it must be confessed that the mining history of Canada warrants the most thorough exploration. How greatly this will be accelerated by the construction of the new road needs no argument to prove. Important finds of oil and coal have already been announced by the surveying parties, and altogether there seems to be good reason for the optimism which prevails in Canada at the present time.

NILES-BEMENT-POND GET INTEREST IN BERTRAM WORKS.

NEGOTIATIONS of notable significance and of great importance to the machinery trade are approaching culmination.

The Niles-Bement-Pond Co., one of the largest machine tool manufacturers in the United States have secured a controlling interest in the John Bertram & Son, Limited, of Dundas, Ont. As the negotiations are not yet fully completed it will be impossible at the moment to give full details of the changes likely to result from this development, yet Canadian Machinery has learned from official quarters that one result of the change will be that Niles-Bement-Pond tools will be made in Canada in the Bertram works. This will mean the erection of several new buildings at the latter works, and it will probably result in an increase of fully 100 per cent. in the number of men employed at the works in Dundas, and an even larger increase in the output from that concern.

The causes that have led up to this development can be said to date back even as far as 1864, when the firm of McKechnie & Bertram was established in Dundas, Mr. John Bertram being the junior partner. While the tools at first made by this concern were somewhat crude as compared with the present output, great care was taken from the start to make every machine rigid and of great strength. The result has been that an enviable name has been built up, and to-day the firm have the reputation of making a line of machine tools which combine in a most satisfactory degree the rigidity of British tools with the up-to-date features of American productions.

The John Bertram Co. have from the start kept in full touch with the progress in machinery construction the world over as well as with industrial progress in Canada. The result has been that they have been to a large degree successful competitors for business when large orders, such as the Canada Foundry Co., and C.P.R. shops, have been on the market.

Niles-Bement-Pond Co. have also, in recent years particularly, been paying much attention to the Canadian market, and have, when heavy tools were desired, probably been the most successful tenderers among the U.S. concerns for business in Canada. They have, however, been greatly handicapped by the duty of 25 per cent. on their tools, as well as by the stiff competition of Canadian firms. As the American firm is exceptionally strong financially, they followed the inevitable course of seeking arrangement with the strong competitors in Canada which would enable them to compete for business in this market more effectively. These negotiations have culminated in the purchase of controlling interest in the Bertram works.

Now the two organizations will be combined to insure greater efficiency in both production and sale in Canada. So far these has been no change personally of the Canadian organization, and as far as can be learned no vital changes will be made. Fuller details will be given in a later issue.

MORE ACCOMMODATION NEEDED

WHAT must be considered a great drawback to the proper display of machinery, machine tools, machinists' and engineering supplies, at the Canadian National Exhibition, is the lack, and a very serious lack, of proper accommodation whereby the manufacturers of such goods might exhibit. In going through the building, nothing could be more noticeable to the visitor than the total absence of manufacturers' exhibits along this line. It seems quite lamentable that such should be the case when these play so important a part in industrial development. Exhibitors who desired space for such purposes found that it was not available and had to content themselves with dwelling upon the situation and leaving to their imagination what an attractive exhibit they could have had were the chance but given. In order that such should not occur another year it is strongly urged on behalf of the manufacturers mentioned that the management of the Exhibition erect a structure commeasurate with the importance, and suitable for the accommodation of these important lines.

SCREW THREAD STANDARD.

GOOD work is being done by the Engineering Standards Committee of Great Britain and if suggestions made in a recent report issued by that body are carried out it will result in the abolition of various discrepancies of practice which have been annoying to engineers and mechanics using screwed bolts and pipes. The report issued relating to this matter is not yet complete as the final standardization involves the further collection of data relative to the gauging of screw threads and plain cylindrical surfaces. It was found, however, that

the pitches originally formulated by Sir Joseph Whitworth meet general requirements, hence they were incorporated in tabulated form in the report. However, it is universally admitted that the finer threads are desirable in certain cases, so that a second table has been prepared relative to fine screw threads. For screw threads of less than ¼-inch diameter the dimensions recommended by the British Association Small Screw Gauge Committee have been adopted. A point not definitely settled was a decision regarding the best means of securing interchangeability between male and female screws.

WATER POWER DEVELOPMENT.

NO matter what may be the outcome of the investigation now being made by the Waterways Commission nor what be the ruling of the Whitney Government in the matter, as to power distribution and its cost, it cannot be gainsaid that the one important consideration as effecting the country at large rests in the matter of the cost of power to the consumer. We have an unalienable birthright in the matter of our water power and no private corporation or political bias should be allowed in any way to act detrimentally to the country's best interests in the matter. Everything points to Canada's industrial supremacy through her advantages in limitless water power. A critical time has been reached in water power development in Canada, particularly as concerns Ontario, from the work that has gone on at Niagara Falls. Millions of money have already been expended and more millions of cash outlay will be required before any appreciable revenue can come to the companies who have shown their faith in the country and in the future of electrical distribution while placing such enormous capital and they should—and there is every reason to believe they will—receive an adequate return for their investment. But as relating to the country's future, it is imperative that the cost per electrical horse power per year be figured to the lowest possible basis. It is strongly advisable that all the water power development on the Canadian side be used in Canadian industries. It is said that sufficient demand does not exist in Canada to serve as a suitable market for the enormous power being developed. Let the companies supply that power at a rate which they well can and still have a fair profit, and the market will arise. Nothing could be more certain.

If the power companies attempt to charge what it is rumored they propose doing in Toronto, and it is to be surmised charges on a like basis within lesser or greater radius of the source of power, it will mean the death knell to electrical power and the hindering and holding back of a wave of industrial activity that fostered at this time would mean everything to future manufacture.

There is another point in connection with the power development problem, and that is its effect on the future of electric traction and hence on transportation. Sufficient advance has been made within the last two years in alternating current motors for electric railway service to place their utility and future position beyond the shadow of a doubt. It is also known that for short distances and numerous runs, the cost of electric transportation is greatly below that of steam. Thus we have a bright outlook regarding cheap transportation, which is an all-important factor to manufacturers and should mean more than would appear at a glance to the manufacturing interests of Western Ontario. Already numerous electric lines operate successfully from town to town, but this is only a beginning and the future will see not only passenger traffic, but heavy freight haulage as well handled by the responsive and powerful electric cars.

Regarding the cost of water power and the saving to manufacturers in Canada from the adoption of electric power industries, Hon. Adam Beck asserts that at present the consumers of the 120,000 H.P., expressly reserved for Canadian users, are using steam, for which they pay not less than $4,000,000 to $5,000,000 per annum, and when the time comes that the steam users of the Province consume 475,000 H.P., which will be available from Niagara, they would pay for that quantity of power generated by steam and coal, not less than from $16,000,000 to $17,000,000 per annum. Mr. Beck believes that within a radius of 200 miles of Niagara Falls power should be delivered at the rate of $15 per continuous horse power per annum for the 120,000 H.P., and when there is a demand for the 475,000 H.P. it should be available at $12 per H.P. year. This would mean a saving to the users of coal of $3,000,000 in the former case and not less than $11,000,000 in the latter. This enormous saving would have its effect in cheapening production, or making possible the payment of higher wages. At all events, the amount is such that all effort towards the saving of the same should be made by the manufacturing interests of the country.

A SERIOUS LOSS.

SINCE our last issue the machine tool interests of Canada have met with a very serious loss in the destruction by fire of the splendid plant of the Canada Machinery Co., Limited, at Sarnia. Besides the building and equipment, a large quantity of machinery was destroyed.

It was rumored at time of going to press that the company would not rebuild, but in reply to a telegram from Canadian Machinery they wired that this report was without foundation.

Recently the property was taken over by a new management and a large outlay and much well directed effort expended to place everything connected with the works in first-class running order.

Canadian Machinery expresses its sympathy with the company in its loss and trusts that with the good times which are bound to prevail in the next few years for machine tool industries the present setback will be fully overtaken.

CROWDED OUT.

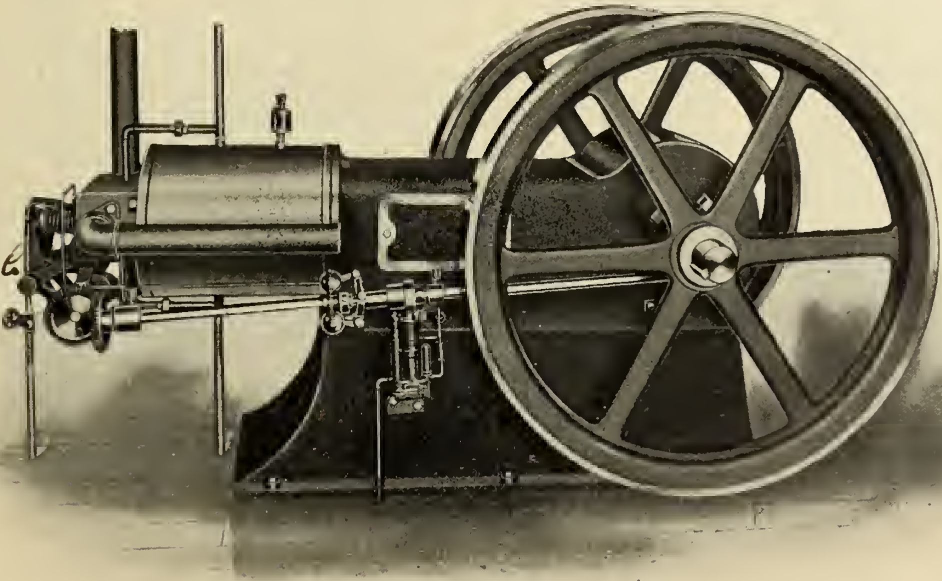
On the subject of the metric system and its bearing on the manufacturing interests of Canada, two interesting letters have been received, but owing to lack of space have unfortunately been crowded out of this issue. Our readers may look for them in the October number.

Power and Transmission

Steam   Gas   Electricity   Compressed Air   Water

THE JOHNSTON OIL ENGINE.

AMONG new power and transmission apparatus the Johnston oil engine, designed and patented by Mr. H. Addison Johnston of Toronto, is coming in for considerable attention. It is essentially different from gas engines and gasoline engines heretofore in use inasmuch as the oil is taken directly to the cylinder instead of being volatilized and mixed with air to form a combustion mixture. In the case of this engine the oil is pumped from a supply tank which may be situated at any convenient point and forced from a jet against a heated plat located against the end of the piston rod, where it ignites and forms the motive power to thrust the piston forward. An explanation of the cycle operations is probably necessary. Before the machine is started it is necessary to heat the plate mentioned above with a plumber's torch, which operation requires but four minutes. As the amount of oil is controlled by the governor and as the air pressure is always carried, being supplied internally by an air tank, immediately on turning the engine to the position in which the oil valve opens a charge of oil is blown into the cylinder by the air and immediately burns, thus giving the first power stroke. As the piston reaches the end of the stroke the exhaust valve opens and allows the products of combustion to pass out on the return stroke. On the succeeding outward stroke a charge of fresh air is drawn into the cylinder through the inlet valve. The return stroke of the piston compresses this air to about 150 lbs. per square inch. At this point the oil is injected, ignites and is completely burned in about 1-75th of a second. The pressure consequently rises and forces the piston forward whence the same cycle of operations is resumed. The governor controls the speed of the engine by decreasing or increasing the amount of oil injected, according as the speed tends to increase or decrease. By thus varying the strength of the impulse instead of omitting entire impulses, as is the custom in gas and gasoline engine construction, a much closer regulation is obtained.



Johnston's Oil Engine.

GOLDIE & McCULLOCH CORLISS ENGINES.

THE GOLDIE & McCULLOCH CO., LIMITED, of Galt, have recently entered into the manufacture of Corliss engines, and the following description is of their standard heavy duty engine, which has been designed particularly for direct connected electrical work, having in view the peculiar difficulties which this work presents.

The frame is of very plain but pleasing appearance, being of the box pattern with all ribbing inside. As it is cast in one piece and supported for its full length on the foundation, there is no possibility of its springing under severe strains of great and sudden changes of load. The bearings are babbitted and are of the four part type with wedge adjustment on both sides. The outside of the shells are turned and the frame casting bored to suit. This permits of an easy removal of the bottom shell by raising the shaft about one-eighth of an inch and rotating the shell around the shaft. The crank pit has a cast iron bottom forming a reservoir into which the waste oil from all parts of the engine can be conducted and drained off.

Out board bearing is ring oiling and babbitted. It rests on heavy cast iron wedges, which in turn are supported by a massive base which reaches to the same level as the bottom of the engine frame. The wedges permit of a vertical adjustment of the whole outer pillow block, while heavy set screws are provided to take care of a certain amount of horizontal movement.

The shaft is of open-hearth forged

steel, with large fillets where there is a change of diameter.

The cranks are of the counterbalanced disc type, and are made of semi steel. The pin is of large size and of open-hearth steel, ground into the crank to a taper fit, shrunk in and secured by a thin nut at the back. The pin is case-hardened and ground to a perfectly true surface.

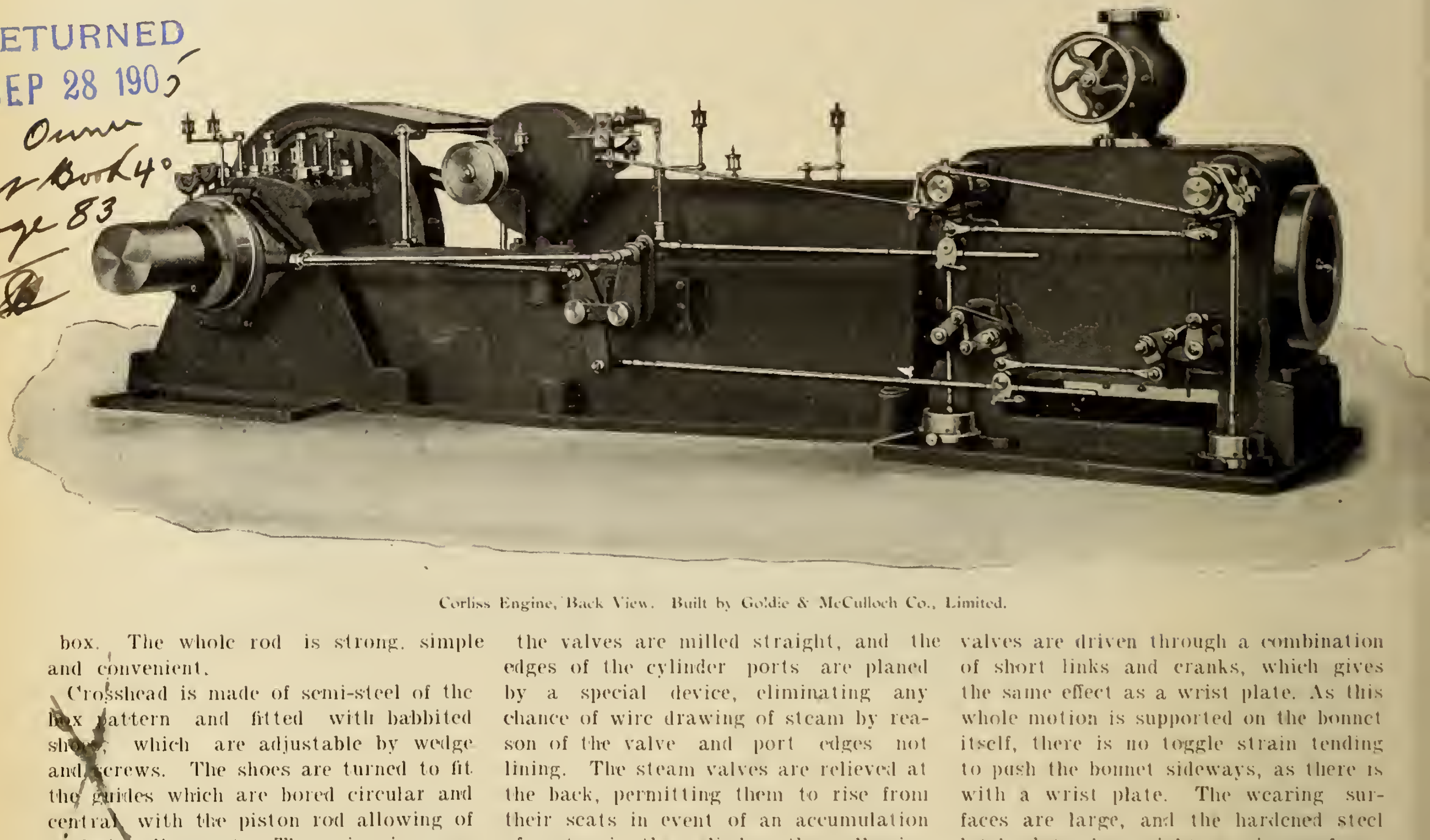
The connecting rod is of solid end type with adjusting wedges which enter the side of the rod and are so placed that in taking up the wear the length from centre to centre remains constant. This arrangement of wedges renders them easily accessible, especially at the cross-head end; it secures greater strength at the ends from the fact that nothing is cut from the section of the rod as with a vertical wedge, and gives a wedge which has a bearing the full width of the

having a steam joint next the frame. The advantage of this is apparent, for, in event of such a joint leaking, it would be necessary to remove the entire cylinder to render it again tight. The exhaust passage is separated from the cylinder barrel by a dead air space, avoiding loss of heat by transfer due to the differences of temperature of the steam in the cylinder and the exhaust. The valves are double ported, insuring ample port opening with small angular travel and consequent minimum of wear. The valve seats are first rough bored, then reamed out with a spiral reamer, and finally lapped out to gauge and a perfect surface. The valves are ground to gauge. This gives a steam-tight contact between valve and seat at the outset and it is not necessary to run the engine some time before the leak past the steam valve disappears. The edges of

Combination, relief, drain and indicator cocks are placed at each end of the cylinder.

The piston is of the box type, and is made with a broad junk ring, which is the full width of the piston. This carries a single packing ring of self-adjusting type.

The valve gear is operated by two eccentrics—one operating the steam valves and one the exhaust valves. The chief advantage of this arrangement is that the governor maintains control of the cut-off up to three-quarters stroke, instead of losing the control before half stroke, as is done with a single eccentric engine. An additional advantage is that the exhaust valves can be adjusted to open and close the exhaust at exactly the proper time. The steam valves are driven direct from the eccentric without a wrist plate. The exhaust



Corliss Engine, Back View. Built by Goldie & McCulloch Co., Limited.

box. The whole rod is strong, simple and convenient.

Crosshead is made of semi-steel of the box pattern and fitted with babbited shoes, which are adjustable by wedge and screws. The shoes are turned to fit the guides which are bored circular and central with the piston rod allowing of perfect alignment. The pin is open-hearth steel with a taper fit in the crosshead, and is case-hardened and ground to a true surface. The piston rod is screwed into the crosshead and secured by a heavy nut. The shoe is held from moving lengthwise on the crosshead by an end plate, which maintains the pin in a central position with regard to the shoe at all times. By taking off this end plate the shoe can be removed without disturbing the crosshead.

Cylinder is cast of hard, close-grained iron. The end next the frame is cast closed. This prevents the necessity of

the valves are milled straight, and the edges of the cylinder ports are planed by a special device, eliminating any chance of wire drawing of steam by reason of the valve and port edges not lining. The steam valves are relieved at the back, permitting them to rise from their seats in event of an accumulation of water in the cylinder, thus allowing it to escape. The steam pressure on all the valves is normal to the seat, which allows the valves to automatically take up the wear and remain tight indefinitely.

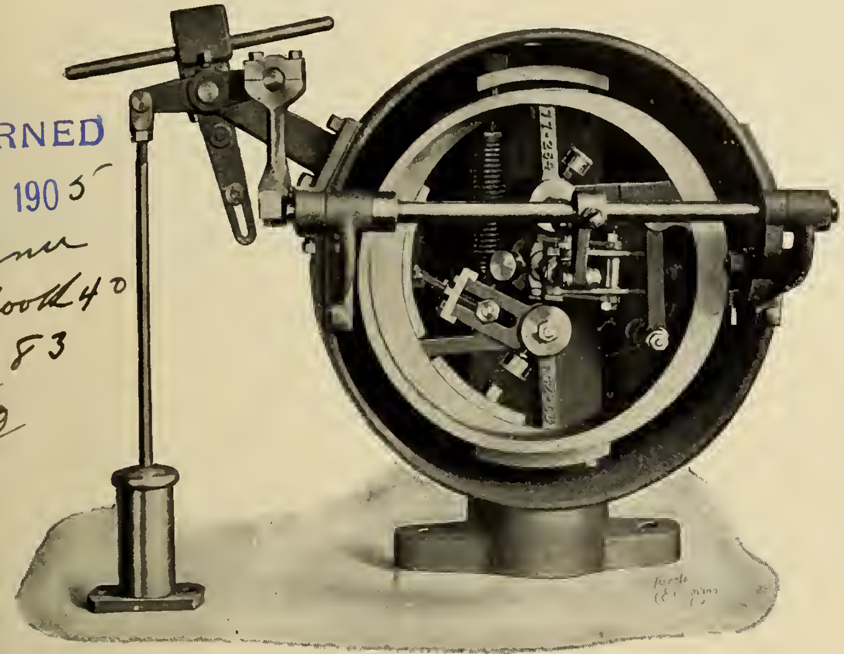
Radiation of heat is prevented by a coat of non-conducting material over which is placed a lagging of sheet steel. A heavy cast iron base plate, with raised edges, is placed under the cylinder, allowing all drips from the cylinder and valve gear to be collected and drained off. The dash pots, which are of the vacuum type, are fastened to this base plate.

valves are driven through a combination of short links and cranks, which gives the same effect as a wrist plate. As this whole motion is supported on the bonnet itself, there is no toggle strain tending to push the bonnet sideways, as there is with a wrist plate. The wearing surfaces are large, and the hardened steel latch plates have eight wearing surfaces, and are provided with a means for adjusting the amount by which one plate laps the other when hooked in. The valve stem lever is keyed to the spindle and is also split on one side and clamped, thus making it impossible for it to become loose. The lever is placed inside the bonnet, which brings it close to the valve and correspondingly reduces the effect of twisting action on the spindle. The device for unhooking the motion from the eccentric rod in order to operate the valve gear by hand is very simple. By rotating the small handle half

a revolution, the reach rod is permitted the block.

The dash pots on engines running up to 120 revolutions are of the vacuum type. Above this speed they are steam actuated.

The governor is the "Rites" Inertia Governor, and is fully covered by patents. The particular features of this governor are its quickness and sensitiveness due to the use of inertia, coupled with small friction and strain of work of tripping the valve gear. While the degree of regulation is much superior to the ordinary type of governor the steadiness is a feature, there being no tendency whatever to "race." For the parallel running of engine-driven alternators of high frequency, this governor is particularly adapted.



Governor Used on Heavy Duty Goldie Corliss Engine.

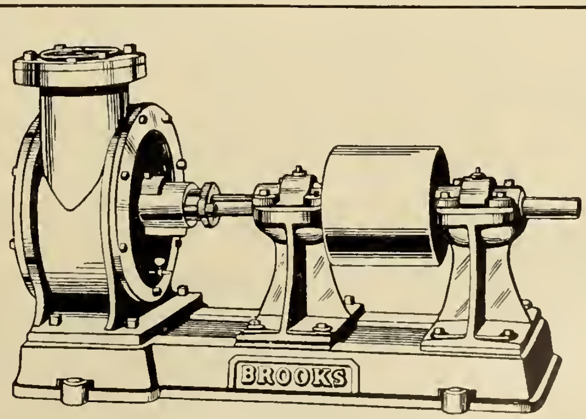
BROOK'S CENTRIFUGAL PUMP.

ONE of the notable features in connection with the Brooks centrifugal pump is the exceptionally high efficiency attained. It is hard to believe that a centrifugal pump is capable of producing a vacuum on the suction of 28.75 inches, but this is claimed to have been obtained when the barometer stood at 29.56. All stock pumps are guaranteed to create a vacuum of within at least $1\frac{1}{2}$ inches of the barometer reading and any of the single stage pumps are good for any pressure up to 60 pounds per square inch.

The volume of water flowing through any centrifugal pump is acted upon continuously by two forces, centrifugal force and atmospheric pressure. Centrifugal force at all times acts radially and perpendicularly to the axis of rotation of the impeller. Atmospheric pressure in the case of an axially disposed inlet pump tends to send the liquid in a straight line in the direction in which it enters the pump—i.e., parallel with the axis of the pump. The path which the liquid will actually pursue is dependent upon the centrifugal force and the atmospheric pressure acting upon it and also upon the manner in which it is controlled, guided and deflected by the construction of the passages through the pump. The construction of the pump should be such as to permit the liquid to take that path which it naturally follows under the combined action of centrifugal and atmospheric pressure, modified (if at all) only by considerations of practical construction. In other words, the power consumed in deflecting and guiding the liquid out of its natural course should be a minimum, as such power is consumed in impact and is wasted.

Obviously all parts of the inflowing column of water will not be equally affected by centrifugal force. That part which enters at the exact centre of the inlet will pass into the influence of the impelling blade at a point where the latter has practically no movement. Accordingly, practically no centrifugal force is imparted to the column along its axial line, and the liquid might flow on indefinitely in a straight line were it not that it is a part of a body or column of liquid which as a whole is deflected and that the blade of the impeller has an appreciable thickness, so that no part of the liquid can enter exactly in the axis of the pump. However, the liquid entering close to the axis of the pump will be deflected radially very slowly at first, and with increasing force and abruptness as it departs from the axis and comes into the influence of the more and more rapidly moving parts of the impeller blade. That liquid which enters at the periphery of the inflowing column will come immediately into the influence of a part of the impelling blade traveling at a relatively high speed, since it is comparatively remote from the axis of rotation. This portion of the column will be deflected much more abruptly and will not be long in acquiring a direction of flow substantially perpendicular or at right angles to the axis of the pump.

In figure 1 these resultant lines of force (the extreme inner and outer) are indicated by the lines a and b, which have been plotted from accurate data obtained from numerous tests. It will be seen that these two resultants are divergent and that the inner curve a is much flatter, while both are very nearly parabolic, and further that these two extremes intersect with the extreme ends of the outlet slots c of the hollow piston. The resultant lines of force, a' and b', will be flatter curves, because the centrifugal force will be less in proportion to the atmospheric pressure. The lines a and b, figure 1, have been superimposed on figure 2 to show this change. The line a' intersects the end wall of the pump and its continuation lies far outside of the pump chamber.



Brooks Pump.

The outer line b' intersects the delivery opening or slot of the impeller toward the receiving side of the pump. This pump would be very inefficient as compared with the pump in figure 1 if driven at the same peripheral speed, because much of the liquid would impact against the end wall of the impeller and would not only waste force, but in being deflected back would create eddies and flowing friction in its passage to the outlet compared to that of the inlet, it usually being greater, whereas it should be less.

Another feature which contributes to the efficiency and the unusual lifting power of the Brooks pump is the lip which overhangs each of the two outlets of the impeller, as shown in the end view, figure 5. These lips are directed tangentially and rearwardly. They perform two functions : serving as guards or division plates, which keep the outflowing columns of liquid from impinging directly against the annular body of liquid between the casing and the impeller, thus minimizing eddying, and to some extent impelling the liquid onward toward the casing outlet. These pumps are manufactured by the Dayton Hydraulic Machinery Co., Dayton, Ohio.

NEW INDUCTION MOTOR.

A RECENT product of the work of the Commercial Electric Company, Indianapolis, Ind., is the constant speed induction motor shown in the accompanying illustration. It was designed by Mr. H. M. Hobart of London, who for years past has been engaged in designing corresponding lines of manufacture for various continental factories. In order to produce a high power factor in these machines, it is essential that they have a limited clearance between the external diameter of the rotor and the internal diameter of the stator. The design of the stator frame and stator head are such that an equal division of this clearance is always secured and maintained, it being impossible to assemble the machine in such manner as to give the rotor an unequal air gap on opposite sides. In order to reduce the wear of the rotor shaft to a minimum, very large bearing surfaces have been provided.

The bearings of these machines are self-oiling and self-aligning and are arranged so that the machines can be conveniently inverted, when location renders it desirable. The bearings are so designed that if the operator should flood them with oil no damage to the machine could possibly occur. The bearings will be made dust-proof where desired. The linings to the bearings are duplicate and interchangeable, so that the replacement of the bearing is a more simple and less expensive matter than is the accurate readjustment of the so-called "adjustable" bearings. The shafts are of crucible steel ; are of large diameter and the dis-

Fig. 2.

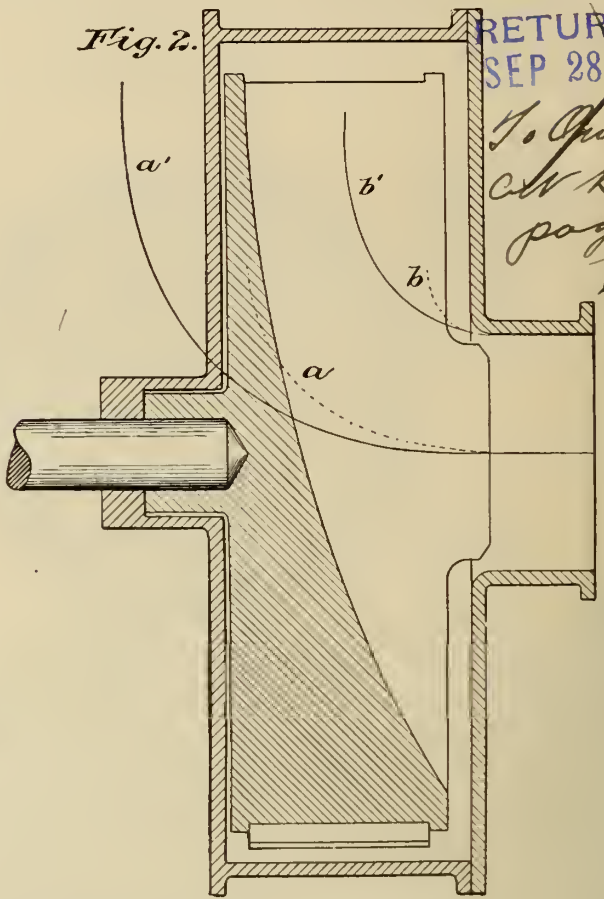


Fig. 1.

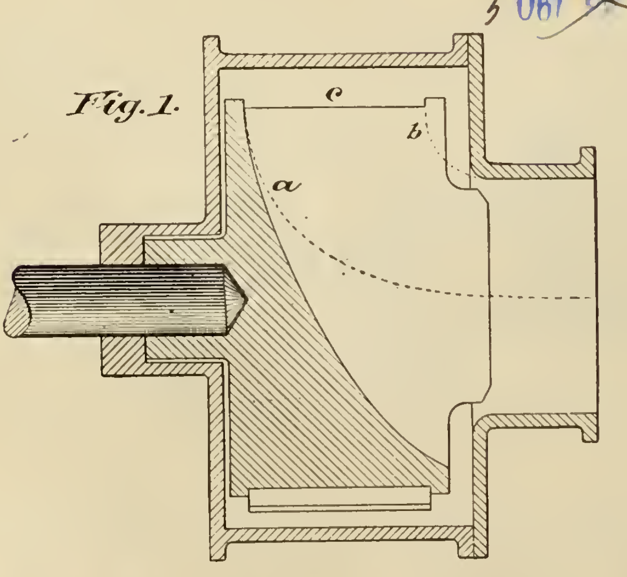
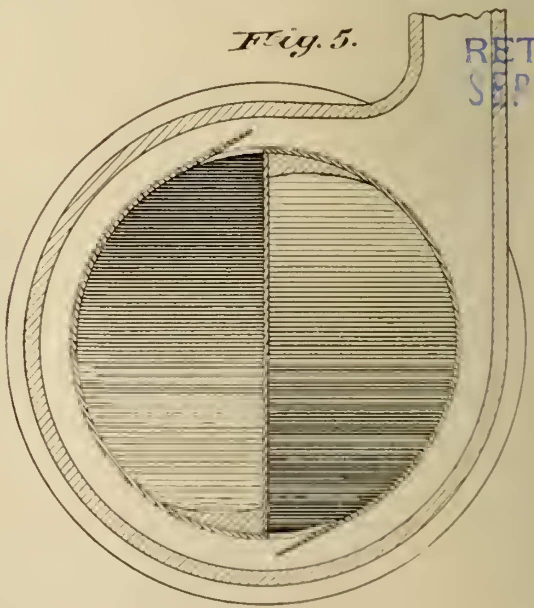
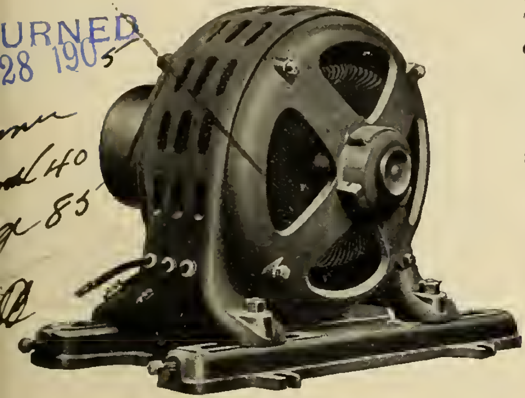


Fig. 5.



tance between bearings is reduced to a minimum so that they are very rigid and are not easily sprung. All shafts are accurately ground to gauge and the



Constant Speed Induction Motor.

bearings are carefully polished. The rotors are mounted on the shaft with hydraulic pressure. Ventilating aperatures are provided across the faces of the stator and rotor cores so that the freest circulation of air is secured, thereby insuring cool operation.

GAS AND GASOLINE ENGINES.

AMONG the gas and gasoline engines exhibited at the Canadian National Exhibition those of the Goold, Shapley & Muir Company, Limited, came in for considerable attention.

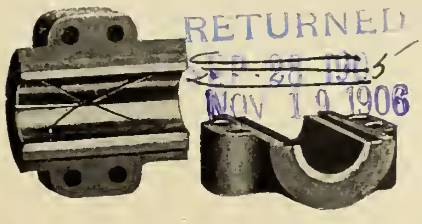
Before being sent out these engines are subjected to very severe tasks and

Igniter.

are run under heavy loads for some time, the horse-power being determined by the brake test, this being as is well known absolutely reliable. The gas and gasoline engines are of the same construction, except that in the gasoline engine a small pump or plunger measures each charge of gasoline as it is ejected in a spray into the air passage leading to the cylinder, while with the gas engine the gas is supplied by pressure when the valve is opened at the proper time to allow the gas to enter the cylinder with the air. In either case the amount of gas or gasoline is measured automatically, and is controlled by the governor. It does not require careful adjustment each time the engine is started, as is the case with many other engines.

The crank shafts and connecting rods are one-piece forged steel, and are turned down to a smooth finish throughout. The shaft boxes or journals are interchangeable and adjustable, and made of the finest phosphor bronze, as are also the connecting-rod boxes.

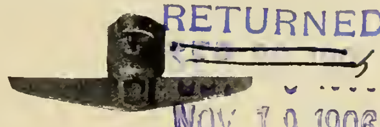
The cams, rollers and studs are of tool steel, carefully hardened and ground to



Phosphor Bronze Bearings.

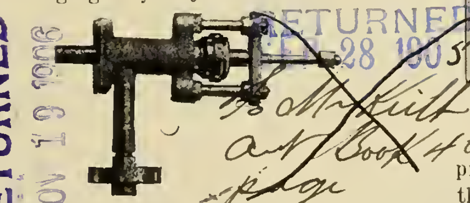
a perfect fit. All bolts, nuts and screws are case-hardened after being fitted and finished.

The pistons are of extra length, and are fitted with double expansion rings, and cannot possibly wear leaky.



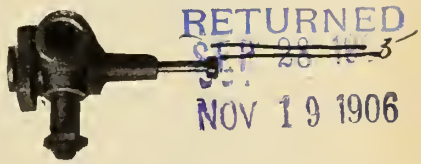
Valve Operating Beam.

The valves of cylinder are one-piece forged steel, and fitted so that both the valves and valve seats can be removed easily and quickly for examination or cleaning without disturbing other parts or changing any adjustments.



Gasoline Pump.

Perhaps the most vital part of the gas and gasoline engine is the igniter, or the device which ignites the gas after it has entered the cylinder. Either the hot tube or electric igniter is furnished as the customer desires. Each has its good points, but the electric igniter is the most convenient where the engine has to be started a number of times daily, and is the most economical and efficient, and we recommend it in preference to the hot tube. The hot tube is the cheapest to manufacture, but not so convenient in starting, especially in the larger sized engines, for care always is necessary in having the tube the right heat, for after it becomes fully heated, when starting



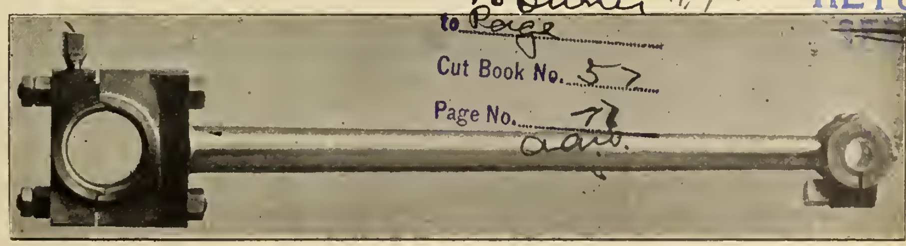
Gas Valve.

the engine is liable to have the gas or gasoline ignited too early in the point of revolution of the crank or stroke, which causes the engine to "kick back."

The double exhaust is one of the most important improvements used on their engine, doing away with the trouble of burned or warped valves. In most engines the exhaust or discharge of the burned gas is accomplished by a valve, which is opened at the end of the piston stroke. After a short time the usual result is a leaky exhaust valve, due to the extreme heat either burning or warping the valve. In an "Ideal" engine no such trouble can occur, for the remaining

Crank Shafts—Rough and Finished.

pressure and heat is allowed to escape through a hole or port in the cylinder casting at the end of the stroke; then after the heavy discharge has taken place, a valve situated in the cylinder head, and surrounded by the water jacket, is opened, and the air only allowed to escape by this outlet when the piston returns to draw in another charge of air or gas. These two outlets are piped separately or carried a short distance from the engine, and then enjoined together with a union before the muffler is attached.



Forged Steel Connecting Rod.

The Development of The Ontario Power Co.

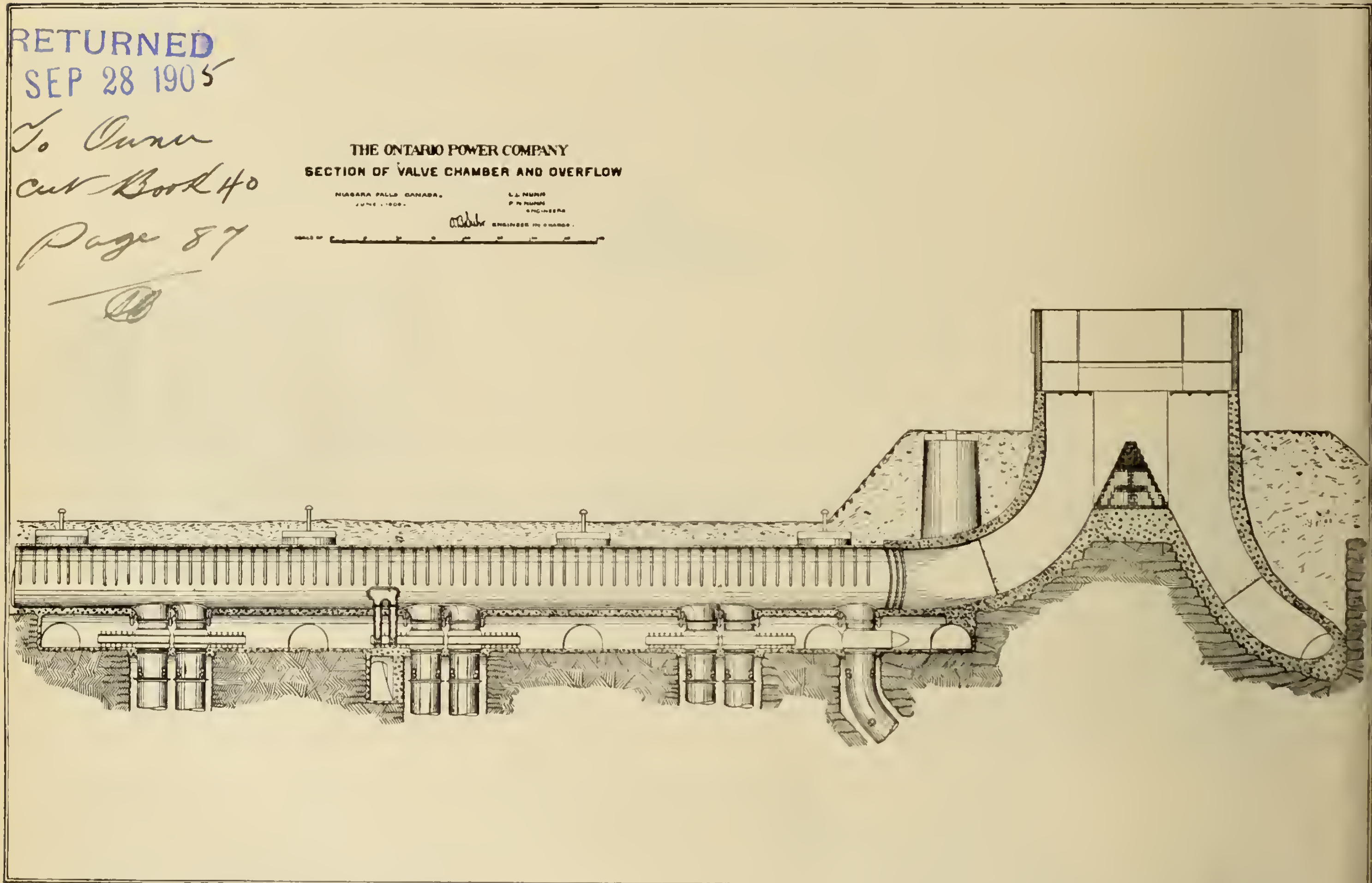
By P. N. Nunn. — Continued from last issue.

At the generating station the corresponding vantage-point is the gallery, where on one side the operator has the motor-driven rheostats, and a few paces distant the commutators and governors of the exciters, and on the other side, in plain sight, the row of main governors with their adjuncts; while from the little switchboard before him he has electrical control of penstock gates and, when necessary, manual control of the turbine speeds, exciter pressure, and field charge. Moreover, from this position he can see all generators and turbines, and, by signal at least, can direct his assistants; little, in fact, is likely to call him to the main floor, unless it be an occasional refractory journal or collector brush.

The power from each generator is conducted to its switch through three single-conductor braided cables carried by line-insulators and isolated by shelf-barriers in a subway beneath the floor. From the switches the three conductors pass to a bell chamber, where between individual barriers they are united into two parallel three-conductor lead-covered and armored cables before entering the tile ducts of the cable tunnel.

Of the features here presented, it is believed that the type of intake, the symmetry of arrangement, centralization of control, and almost perfect isolation of apparatus represent, to some degree at least, distinct advances in power-plant design; and while few works of such dimensions may be built for many years, if ever, it is possible that in a way some of the purposes and methods thus briefly presented may, until superseded by the next advance, be of some service as suggestions to other designing engineers of similar works. The unusual, even enormous volumes, both of water and of power, involved not only in the individual units, but also in the aggregate, have presented new problems unprovided-for in standard sizes of apparatus, thus necessitating the development of larger capacities and the creation of new types. Hence, the work of designing and building has been burdened with incessant test, re-design, and adaptation unknown in more conventional engineering.

It has been suggested that any account of this work would be incomplete without mention of those mainly responsible for it. Justice to all is here impossible, but a few may be named. Mr. O. B. Suhr has from the beginning been in charge of the engineer corps and to him is largely due the harmony of design. Mr. V. G. Converse, Mr. C. H. Mitchell, and Mr. J. B. Bailey are chiefs of the electrical, mechanical, and field departments respectively, and Mr. J. R. Harsch, of the clerical work of the engineers. But more than all else in the establishment of this great and daring enterprise stands out the attitude maintained towards their engineers by Messrs. J. J. Albright and Edmund Hayes, the originators and majority owners, who in strong contrast with the harassing interference by which uninformed investors frequently spoil the best efforts of engineers, have in this case given not only absolute freedom of action, but also steadfast support.



Machinery Development

Metal Working **Special Apparatus** **Wood Working**

ROCK AND ORE CRUSHER.

A GYRATORY type of rock or ore crusher has just been designed by the Canada Foundry Co., Limited, this style of crusher having been found from experience to be the most desirable for all grades of material. They are less massive than the jaw type, require less power to drive, and are more economical in repairs. The sectional view shown gives a good idea of the style of machine, showing the various parts and their relative positions. The chief characteristic of this machine is its strength, as it has been designed that each part is amply proportioned to withstand the severest strain which can be put upon it. The shaft is suspended from a large bearing at the top, and there is a long leverage between the eccentric and the head.

The parts of the main frame are massive iron castings, strongly ribbed and securely bolted. The head and concaves are of manganese steel. The shafts are forged from open hearth steel billets and afterwards accurately turned and polished. The eccentric is of cast iron with a facing of high-grade babbitt metal. It is cast in one piece with the bevel gear, which prohibits any possibility of loosening. The wearing ring is of high-grade bronze. The wearing plate is of chilled semi-steel. The gears are heavy iron castings, specially designed to meet the requirements, and are extremely durable and smooth in operation.

A NEW WINDMILL.

THE one source of power bestowed by nature on the prairie farms of the country has heretofore proved largely unavailable because of the danger to machinery involved in permitting windmills to run during heavy storms. For a new invention it is claimed it will transmit power, says the Draftsman, not exceeding a predetermined limit, no matter how strong a wind is blowing. This new windmill has two wind wheels with sails oppositely inclined so they will run in opposite directions. As the velocity of the wind increases the wind wheels are tilted upwards, thus modifying the force of the wind on the sails. The shaft of the inner wheel is hollow and revolves on the shaft of the outer wheel, and the bracket in which the shafts are mounted has a universal joint connection with the windmill standard, an adjustable counter-weight balancing the weight of the wind wheels.

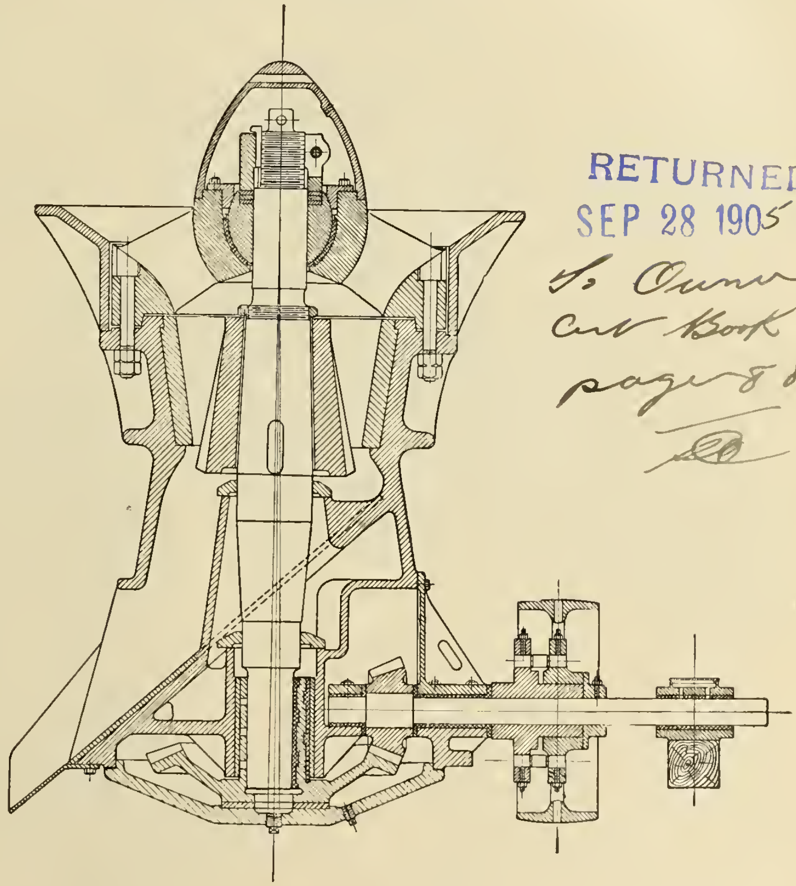
The shafts carry bevel gears at their inner ends, that of inner wind wheel engaging the upper teeth of the power wheel, while the gear attached to the shaft of the outer wind wheel engages the lower teeth of the power wheels. Consequently, although the wind wheels turn in opposite directions, they both act together in driving the power shaft in the same direction. A blade or sail lying adjacent to and below the level of the wind wheels forms the vane of the mill, which occupies a plane normally transverse to the direction of the wind. As the strength of the wind increases the wind wheels rise because of the pressure against this vane, and the wheels then rotate at an acute angle to the direction of the wind. In this way the force of wind on the wheels is modified, for any increase in velocity will be compensated for by an increase in the angle between the axis of the wheel and the direction of the wind.

COWAN & CO.'S MOULDERS.

A NEW line of moulders is being placed on the market by Cowan & Co., Ltd., of Galt. This machine embodies several advantages and conveniences not contained in other moulders. The frame is well braced and is not extended for support of the countershaft. The feed consists of four large rolls, all driven by cut gears, sufficiently strong to withstand hard and continuous service on any quality of lumber, regardless of the depth and width of cut.

The upper rolls are raised and lowered parallel with each other. Two rates of feed are regularly furnished, 25 feet and 40 feet per minute, but if it is desired the moulder can be fitted with variable feed regulation from zero to 60 feet per minute.

Instead of the ordinary bored head and spindle, this moulder has both the bottom and top heads of special high carbon steel forged from the solid bar and slotted on four sides, thus being more rigid. A special feature of the machine is that



Section of Ore Crusher.

the lower head cuts first, giving the stock a flat even surface to rest upon when being operated on by the other heads. By releasing a lock it and the platen back of the cut can be drawn out for setting and sharpening the knives; it is also adjustable laterally. The raising and lowering screw works on ball bearings.

The table at feeding-in end is independently adjusted to suit any required depth of cut on the lower cylinder. The chip-breaker, pressure feet and all parts over the bed can be instantly thrown out of the way, facilitating the setting and adjustment of cutters.

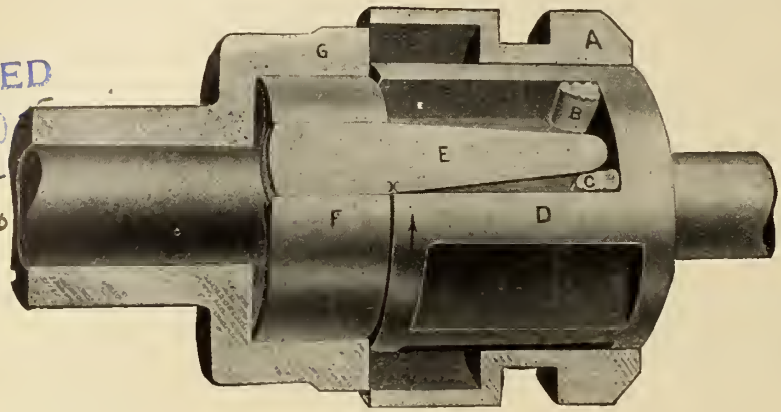
The machine is made in two sizes, 10 feet and 12 inches wide. The countershaft is placed at feeding out end of machine, preventing belts from rubbing the frame and doing away with the use of idlers, as well as being out of the way of the operator.

Further particulars of the machine may be obtained from the manufacturers on request.

AN AUTOMATIC CLUTCH.

CLUTCHES, to perform their work to the best advantage, should be designed to fulfil certain requirements, foremost amongst which is that the operator should have perfect control, being able to accelerate a load from rest to full speed uniformly, and also disengaging it with ease. When totally engaged a clutch should not slip, it should cause a positive union between its members and be able to transmit the power with the same factor of safety as the members. In cases where a clutch is required to slip when a given load is exceeded, this requirement should be applied. No adjustment or attention should be required during its lifetime, outside of frequent oiling. It should be simple and compact in construction, neat in appearance, round and smooth, with no projecting parts. The life and durability of a clutch should be as great as possible, and have interchangeavle wearing parts. A clutch should operate satisfactorily running at any speed, and with any amount of oil.

In the diagram shown the clutch is represented in the disengaged or off position. A is the operating sleeve which carries the pins B and C, shown in section, which fit between the faces of the cavity in the keyed member D. Loosely placed between the pins B and C is a lever E, which extends between the ends of the expansion ring F, which is surrounded by the cup or loose member G Now if the keyed member D be rotating in the direction indicated by the arrow, the ring is freely revolved by the lever E, which is driven at point x, as pin C is free of the lever; and pin B operates on the lever only when the member D is revolving in the opposite direction. When the clutch is engaged the sleeve A is moved to the left, and the pin C gradually relieves the bearing point x on the lever, and the member D drives the ring by the lever through the pin C. This causes the lever E to expand the ring F within the cup G, with such pressure that the friction created exceeds the force on the lever, therefore the greater the load the tighter the grip. This clutch is manufactured by the Automatic Clutch Co., Akron, Ohio.

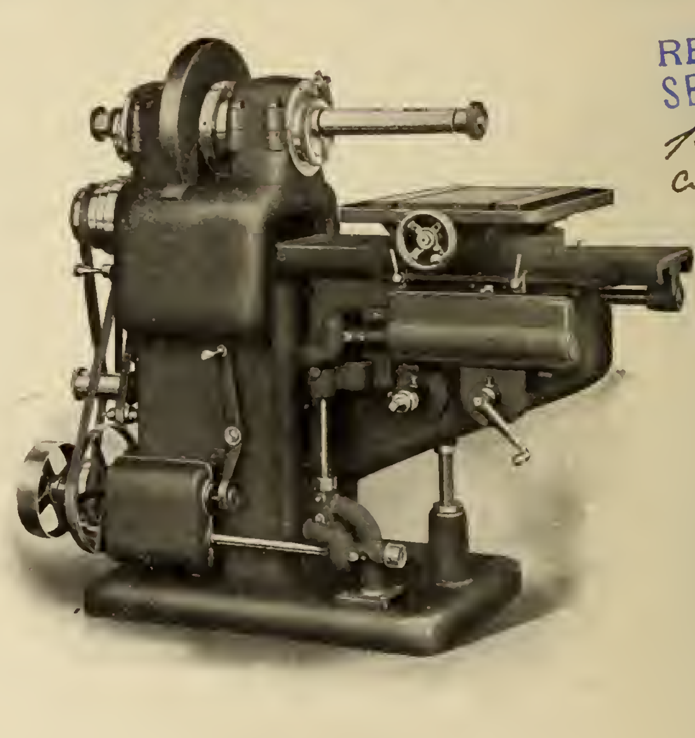


An Automatic Clutch.

HEALD CYLINDER GRINDER.

THIS machine has been developed for the accurate finishing of gas and gasoline engine cylinders, and internal grinding of parts which are of such shape that it is impracticable to rotate them. It is intended to meet the demand for a better method of finishing the interior of engine cylinders than that heretofore employed. In the construction of automobile engines especially the walls are necessarily thin and when the surface is finished by boring or reaming there is a continual tendency on the part of the iron to spring away from the cutting tool. If there are hard and soft spots in the iron, it is almost impossible to have the boring tools cut a perfectly round hole, as the iron in this thin shell will spring away from the tool and come back again after the tool has passed on. With grinding, however, this is not the case, because there is not the pressure against the walls of the cylinder with the grinding wheel that there is with a boring tool, especially where sharp and free cutting wheels are used. The character of the surface also is, for reasons readily understood, far more perfect than can be obtained by boring or reaming.

The machine illustrated by the accompanying cut consists of a main frame or


Heald Cylinder Grinder.

column carrying a grinding spindle which revolves about a horizontal axis. This grinding spindle is mounted in double eccentrics, thus giving a sort of a planetary motion to the spindle and grinding wheel, and making an effective device for getting the correct diameter of the holes and insuring their being perfectly round. Five different speeds of rotation are given to the eccentrics to handle work of different diameters and conditions. The wheel spindle runs in bronze boxes, provided with a simple adjustment for wear. The end of the wheel spindle is made tapering to receive wheels mounted on colletts, thus allowing wheels to be changed without delay in trueing up. Provision is also made for feeding out the wheel to regulate the depth of the cut while the machine is in motion. On the front of the column is a knee, carrying the main sliding table, which travels back and forth in a line parallel to the grinding spindle. On the top of this table is a cross slide table for giving cross wise adjustment. In the operation of this machine the work does not rotate. This method of handling also makes it possible to grind duplex cylinders as readily as single cylinders, an advantage that will be greatly appreciated. By means of the vertical adjustment of the knee on the column and the cross wise movement of this upper table, any adjustment of the work can be obtained, either to bring a single hole in line with the grinding spindle or to transfer the work from one hole to another, as is necessary when duplex cylinders are to be ground.

This machine will grind holes from 3 to 8 or 10 inches in diameter, by using the proper sized wheels, and any length up to 15 inches with the extension regularly furnished, but this can be increased if necessary. The grinding wheel usually used is 3½ inches in diameter by ¾-inch face. The work is held in position by a jig or other fixture on the table, which travels in a line parallel with the driving spindle. The inner stroke brings the end of the table within the column, which is cut away for that reason. The table is in two parts, comprising a lower side, 45 inches long by 13 inches wide, carrying the table proper, which is 20 inches long by 14 inches wide and has a transverse movement of 9 inches. The knee has a vertical adjustment of 4½ inches, which with the transverse movement of the table allows for the making of all adjustments. Micrometer indexes are provided for these adjustments, by means of which it is possible to grind duplex cylinders, maintaining the two holes in exact line, one with the other. One hole having been ground to size the table is moved transversely until the second hole is in line for grinding. The greatest distance of the main table below the centre of the grinding circle is 12 inches.

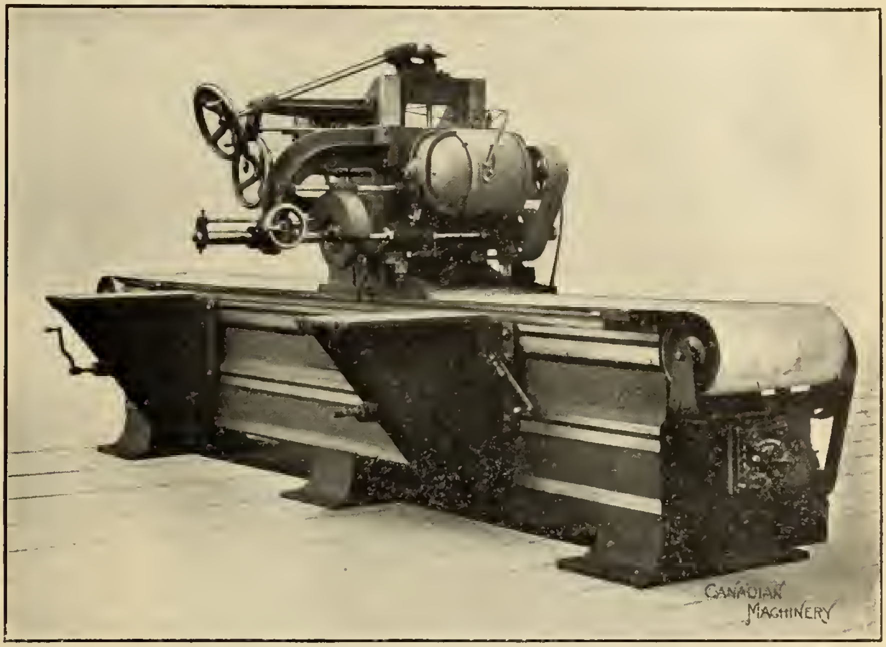
The travel of the table is automatic, reversing accurately at any point desired. The rate of traverse is controlled by a change gear box on the column of the machine, giving three different rates of feed to the table.

It is manufactured by the Heald Machine Co., Worcester, Mass., who will be glad to send fuller information regarding this machine.

TRAVERSE GRINDER.

A MACHINE has been designed especially for grinding manganese cast steel centres of railroad frogs and crossings, locomotive cross head guides, finishing butt ends of connecting rods, etc., and is also adaptable for grinding the ways between the V's on lathe beds, and for other grinding purposes, by the Cincinnati Shaper Co., Cincinnati, O.

The bed cast in box form and liberally braced internally, by means of cross girts, is made in varying lengths, the illustration showing one 15 feet long, which permits a longitudinal travel of the saddle, carrying the wheel, etc., of 12 feet. The saddle is traversed by a 2-horse-power motor through a rack and pinion with a speed of 15 feet per minute, and is automatically reversed at each end of each stroke, which may be of any length up to the limit of the machine. The grinding wheel, driven by a 5-horse-power motor at a speed of 1,500 revolutions per minute, has a horizontal movement in the direction of its axis of 15 inches and a vertical movement of 11½ inches, these movements being operated, one by the hand wheel attached to the bracket supporting the grinding wheel shaft, and the other by the large hand wheel whose shaft is set at an angle. The third hand wheel is for moving the saddle by hand when desired. The motor is adjustable on the saddle, for the purpose of tightening the belt driving the grinding wheel shaft. The tables are horizontally adjustable along the bed, by means of a rack and removable ratchet wrench, and vertically by means of a screw, operated by the socket wrenches attached to them. A pump and system of piping is provided for supplying water to the grinding wheel, and canvas curtains also for protecting the sliding ways on the top of the bed from grit. All controls are located in the saddle, a lever, not visible in the illustration, being provided for reversing the saddle by hand when desired.



Cincinnati Traverse Grinder.

MOTOR DRIVEN BOLT THREADER.

ON account of the fact that bolt threading machines are frequently placed in forge shops or in isolated places where it is difficult to convey power to them, and further, as there is a general demand for direct motor driven machines, the National Machinery Co., of Tiffin, Ohio, have placed upon the market a line of their bolt threading machines arranged for direct motor drive.

Reference to the accompanying illustration shows the method of applying the motor, and to provide a thoroughly flexible equipment the National Machinery Co. have equipped their machines with a suitable speed change device so that the proper cutting speeds can be secured through the change gears even

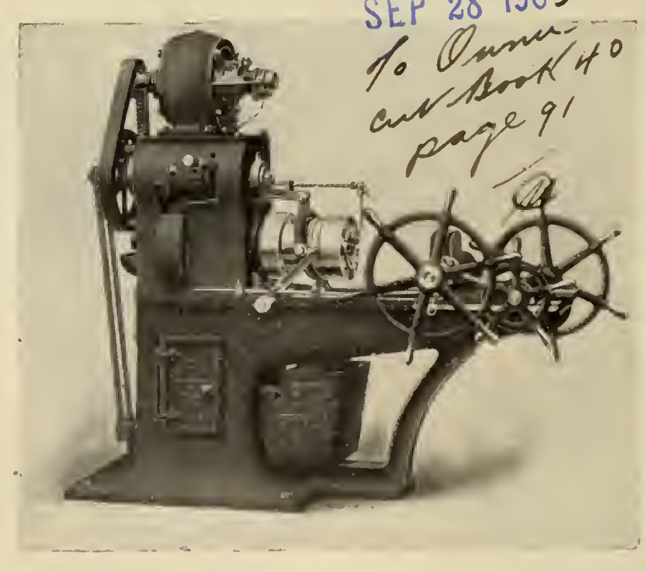
when the motor is of the constant speed type.

The illustration is of a machine of 1 1-2 inch capacity, and the gearing in the speed box provides four changes of speed, enabling the machine to handle work of all sizes within its capacity at the proper cutting speed. It is not necessary to use a variable speed motor, but if the utmost refinement is wished, by using a motor having a speed variation of from 1 to 1.4 a great range of cutting speeds can be secured, as the total speed variation will be as 1 to 5.5.

In designing this line of machinery the aim of the National Machinery Co. has been to combine effectiveness with simplicity, and this result has been secured to a surprising degree, as a minimum number of gears are employed in the speed box, and all of the movements of the gears and the various speed changes are secured by shifting of one hand lever only. The gears are of large size, and are of wide face, and there are no gears or pinions sliding on feathers; neither are prong clutches employed.

The illustration shows the motor connected to the speed box by a silent running chain, but it is possible to furnish this equipment using a raw hide idler, and a gear drive direct from the motor. By placing the motor over the head spindle of the machine the floor space is reduced to a minimum, and the motor is out of the way of oil and dirt, and in addition all of the driving gears are incased.

These machines are built in all sizes from one to six inch capacity, each size having a proper number of cutting speeds to handle the work for which it is designed.



New Bolt Threading Machine.

THE GRONKVIST DRILL CHUCK.

IN these days a time-saver in a machine shop is a big money-saver. Wages form one of the most important items in the cost of production, owing to the big mnoey commanded by the skilled mechanic. The efforts of inventors, therefore, have been largely directed of late years towards producing equipment by means of which the incidental work of the workman is diminished, and his time devoted as much as possible to the money-producing output of the shop.

One of the most successful money-savers to come to notice of late is the Gronkvist drill chuck. The cardinal feature of this chuck is that drills can be changed while the machine is running at full speed, and without the use of a wrench. This latter point has an important bearing on the lasting qualities of the chuck.

The many good features of this chuck are explained in a neat booklet which is published by the Gronkvist Drill Chuck Co., Jersey City, N.J., whose Canadian agents, McLean & Sophus, Montreal, will be pleased to communicate with all interested parties. Copies of the pamphlet referred to will be sent to anyone who mentions Canadian Machinery in writing.

ELECTRICALLY DRIVEN SHOP SAW

THE shop saw is very clearly shown in half-tone engraving and scarcely needs any description. The motor is completely enclosed within the housing and cannot be injured by dirt or anything getting into it. The starting switch is also enclosed, and is operated by the handle at upper left-hand corner of housing. The saw feeds by gravity, and has an automatic stop which releases the switch when work is cut off.

Electrically Driven Shop Saw.

It is designed for 12 feet saw blades, and will cut off stock 1½ feet in diameter. The motor has self-feeding carbon brushes, self oiling bearings with renewable bushings, ironclad armature with tool steel shaft, and is made with the greatest care.

The machine weighs complete 310 lbs and the motor is wound for 110 or 220 volts direct current. They are being placed on the market by James Clark, Jr., & Co., Louisville, Ky.

HIGH SPEED STEEL KNOWN TO ANCIENTS.

IN a paper recently read before the Iron and Steel Institute, Mr. J. M. Gledhill stated that the famous Damascus steel was in reality nothing but a form of our modern high speed tool steel, for it contained all the important properties of the latter. Marvelous cutting powers have been attributed to it and recent analyses of the material show that it contained certain percentages of tungsten, nickel and manganese. This shows that a latent high speed steel was in existence centuries ago. All that was found necessary in order to bring out its inherent qualities was to "burn" it, a process which was long thought to destroy its usefulness, but which is now known to produce its greatest adaptability to the work in hand and render it capable of effecting a great revolution in machine shop practice.

Companies Incorporated

The Stuart Machinery Co., Limited, of Winnipeg, will apply for the right to increase their capital stock from $49,000 to $200,000.

The Kerlin Brother Co. of the State of Ohio have been granted the right to do business in Ontario to the extent of $30,000, with H. E. Rose of Toronto as its attorney.

Builders' Equipment Co., Ltd., Winnipeg, share capital $120,000. The directors are A. Macaw, A. L. Bredin, L. C. Hazlett, J. A. Tanner and W. J. Cummings, all of Winnipeg.

The Burns Co., Limited, Oshawa; capital, $20,000; purpose, to manufacture and sell general merchandise; directors, W. J. Burns, A. E. Burns, and F. N. Burns, all of Oshawa.

Ault Bros., Limited, Aultsville; capital, $40,000; purpose, to manufacture and deal in goods, wares and merchandise; directors, C. S. Ault, A. W. Ault and A. E. Ault, all of Aultsville.

The Power and Gas Machine Co., Limited, Galt; capital, $100,000; purpose, to manufacture and deal in gas generators, etc.; directors, W. H. Cone of Berlin, and F. E. Brown and W. Foster of Galt.

The Bates Mfg. Co., Limited, Toronto; capital, $100,000; purpose, to manufacture and deal in wares, goods and merchandise; directors, T. Bates, R. T. Duffy and A. G. Brown, all of Toronto.

The Jones & Moore Electric Co., Ltd. Winnipeg, share capital $75,000. The directors are J. W. Jones, of Toronto, and G. J. Hicks, L. M. Delbridge, J. C. Kavanagh, and C. W. Bradshaw, of Winnipeg.

Monarch Realty Corporation, Winnipeg; share capital $40,000; purpose, to carry on the business of a land company. The directors are C. H. Brooman, R. A. Jones, P. Ulrich, C. Smith, and C. J. O'Toole.

The Detroit & Kent County Oil and Gas Co., of Ontario, Limited, have been granted the right to do business in Ontario to the extent of $40,000, with W. Jackson of Osborne P.O., Ont., as its attorney.

The Algonquin Co., Limited, Toronto; capital, $300,000; purpose, to operate timber limits, saw mills, etc.; directors, T. Minton, F. Sinclair, W. Bullock, J. Creighton and G. T. Bullock, all of Toronto.

The Atlantic Soap Co., Limited, Toronto; capital, $40,000; purpose, to manufacture, refine and deal in soaps, oils, chemicals, etc.; directors, F. N. Vanzant, S. Jardine and D. G. Buchanan, all of Toronto.

The Pembroke Rink Co., Limited, Pembroke; capital, $20,000; purpose, to erect and maintain a hockey and skating rink; directors, A. Millar, J. S. Fraser, R. W. Gordon, W. H. Bromley, E. Behan and A. Morris.

The Gore Bay Brick & Tile Mfg. Co., Limited, Gore Bay; capital, $3,000; purpose, to manufacture brick and tile; directors, R. R. McKessock, R. J. Porter, J. W. Jackson, R. J. Armstrong and W. Burns, all of Gore Bay.

The Linton Realty Co., Limited, of Montreal; capital, $45,000; purpose, to erect, construct and alter houses, buildings, etc.; directors, W. G. Ross, H. P. Douglas, C. Archer, J. E. Perrault, R. G. LeBarre, all of Montreal.

Albion Stove Works, Limited, Victoria, B.C., share capital $30,000, purpose to take over the stove business of the Albion Iron Works. The provisional directors are J. A. Mara, F. S. Barnard and John Bryden, all of Victoria.

The Plumbing & Heating Supply Co., Limited, Toronto; capital, $100,000; purpose, to manufacture and deal in all kinds of plumbers', steamfitters' and heating supplies, etc.; directors, F. Armstrong, W. Mansell and D. Fasken.

The D. M. Steward Mfg. Co. of Canada, Limited, Toronto; capital, $40,000; purpose, to manufacture and deal in gas burners, insulators, etc.; directors, C. S. Steward of Chattanooga, Tenn, W. H. Frazier and S. L. Ezell of Toronto.

The Eclipse Umbrella Co., Limited, Montreal; capital, $100,000; purpose, to manufacture umbrellas, suspenders, haberdashery, etc.; directors, J. R. Gordon, F. Worden, G. W. Shewan, R. A. Sunton, D. Patterson, all of Montreal.

Port Arthur Iron Mines, Limited, of Toronto; share capital $500,000; purpose, to carry on the business of a mining, milling, reduction and development company. The directors are W. H. Moore, G. G. Ruel, and F. C. Annesley, all of Toronto.

The New Ontario Ore Refining Co., Limited, Toronto; capital, $500,000; purpose, to carry on the business of a mining, milling, reduction and development company; directors, T. H. Barton, O. F. Taylor and A. W. Barton, all of Toronto.

St. Lawrence Supply Co., Limited, Montreal; capital, $20,000; purpose, to carry on a business as machinists and engineers; directors, W. A. McKay, J. G. Veith, A. R. Oughtred, and M. A. Phelan, of Montreal, and E. G. Place of Westmount.

The Wallaceburg Brass & Iron Mfg. Co., Limited, Wallaceburg; capital, $40,000; purpose, to manufacture brass and iron goods; directors, D. A. Gordon, A. LaCourse, H. W. Burgess, H. J. McDougall and J. F. McDougall, all of Wallaceburg.

The Buffalo Mining Co., Limited, of Fort Erie; share capi[illegible] purpose, to carry on the business of a mining, milling, reduction and development company. The directors are C. L. Dennison, R. W. Pomeroy, and G. C. Miller, all of Buffalo, N.Y.

The Myres Iron Fence Co., Ltd., Winnipeg, share capital $35,000, purpose taking over the business of the Myres Fence Co. and the Canadian Implement Co. The directors are R. L. Myres, P. C. Young, W. F. Salter, T. G. Mathers, and E. Spice, all of Winnipeg.

N. J. Holden Co., Limited, of Montreal; capital, $200,000; purpose, to manufacture and deal in any kind of apparatus used in the transportation of persons or property; directors, L. Johnson, W. Palmer, A. L. DeGuire, P. A. Masse and C. Bethell, all of Montreal.

New Ontario Cobalt & Silver Mining Co., Limited, of Ottawa; share capital $1,000,000; purpose, to carry on the business of a mining, milling, reduction and development company. The directors are L. Bedell of Goshen, N.Y., and W. A. Allan and J. T. Lewis of Ottawa.

The St. Lawrence Supply Co., Limited, of Montreal; share capital $20,000; purpose, to carry on a general business as machinists and engineers. The directors are W. A. McKay, J. G. Veith, A. R. Oughtred and M. A. Phelan, all of Montreal, and E. G. Place of Westmount.

Kerr Lake Mining Co., Limited, Toronto; capital, $40,000; purpose, to carry on the business of a mining, milling, reduction and development company; directors, E. Steindler, D. M. Steindler, J. J. Steindler, W. J. White, all of New York, and J. A. Jacobs of Montreal.

The Improved Match Co., Ltd., Montreal, share capital $75,000, purpose to carry on a business as general merchants and manufacturers. The directors are H. D. Metcalfe, of Westmount, H. H. Snowdon, C. P. Metcalfe, C. J. Anderson, C. A. Morin, F. C. Saunders, all of Montreal.

The Western Lighting Co., Limited, of Rosser; share capital $20,000; purpose, to carry on a business as manufacturers and dealers in all kinds of illuminating supplies, etc. The directors are E. E. Price and R. Price of Rosser, and W. P. Rogers, W. F. Farrow, and R. G. Afleck, all of Winnipeg.

N. J. Holden Co., Ltd., of Montreal, share capital $200,000, purpose to manufacture and deal in apparatus which may be used for or as incidental to the transportation of persons or property. The directors are L. Johnson, W. Palmer, A. L. DeGuire, P. A. Masse, and C. Bethell all of Montreal.

The E. Guillet & Sons Ltd., Marieville, Que., share capital $150,000, purpose to acquire and develop any water power in order to supply electrical power. The directors are E. Guillet, H. D. Guillet and H. W. Jewett, of Marieville, Que., J. H. McKechnie of Granby, and T. Gnaedinger, of Montreal.

The Cataract Electric Co., Limited, of Orangeville; share capital $50,000; purpose, to construct and maintain works for the production of electricity for purposes of light, heat and power. The directors are J. M. Deagle and E. M. Deagle of the township of Caledon, and F. Deagle of the township of Artemesia.

The Dymond & Abitibi Mining & Development Co., Limited, New Liskeard; share capital $25,000; purpose, to carry on the business of a mining, milling, reduction and development company. The directors are J. Wilson, J. McCracken, J. Mason, C. A. Marwahn, J. Scott, W. J. Tindall, and W. J. Evans, all of New Liskeard.

The North River Power Co., Ltd., of Montreal, share capital $90,000, purpose to manufacture and deal in apparatus for the manufacture of electricity, etc., and tools, wire, lamps, etc. The directors are R. Bickerdike A. Fogarty, J. A. Mann, W. R. Stavely, all of Montreal, and H. W. Robertson, of the village of St. Andrews, Que.

The Randolph Macdonald Co., Limited, Three Rivers, Que.; capital, $100,000; purpose, to take over the business of contractor now carried on by Ran-

dolph Macdonald at Toronto; directors, R. Macdonald of Toronto, W. R. Macdonald and W. H. Marrow of Three Rivers, A. Stephen of Collingwood, and M. McAndrew of St. Catharines.

The Anti-Mal-de-Mer Belt Company, Ltd., of Montreal, share capital $90,000, purpose to manufacture and deal in appliances for the prevention of seasickness, etc., and machinery, utensils, etc., pertaining thereto. The directors are C. C. Knight, E. A. Davis, E. J. Williams, G. E. Hyndman, and B. C. Howard, all of Sherbrooke, Que.

The Windsor & Cobalt Mining Co., Limited, Windsor; capital, $150,000; purpose, to carry on in all its branches the operations of a mining, milling, reduction and development company; directors, John Scott of Windsor; J. S. Austin, J. W. Kerr and M. Price, of the township of Maidstone, in the county of Essex, and G. A. Wintemute and J. F. Millen of Sandwich.

The Temiscaming Mining Co., Limited, of Haileybury; share capital $100,000; purpose, to carry on the business of a mining, milling, reduction and development company. The directors are C. A. Richardson of St. Catharines; J. L. Wheeler of Emporium, Pa.; R. A. Cartwright of Brockport, Pa.; B. E. Cartwright of Buffalo, N.Y.; and J. F. Gillies of Haileybury, Ont.

The Sucker Creek Gas & Oil Company of Anderton, Limited, of Amherstburg; share capital $50,000; purpose, to bore and drill for oil, petroleum and natural gas. The directors are J. G. Mullen, W. H. McEvoy, J. A. Auld and H. Clay, all of Amherstburg; H. G. Duff and W. H. Gatfield, of the township of Anderton; J. Anderson of Windsor, and E. Winters of Leamington.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

CANADIAN-BUILT locomotives are being purchared by the Grand Trunk Railway for its Canadian lines. The road has recently added to its equipment on the western Ontario lines 15 ten-wheel passenger engines and ten compound Mogul locomotives for freight service. These have been built and delivered by the Locomotive and Machine Company of Montreal. Still another 15 Mogul locomotives have been constructed and handed over by the Kingston Locomotive Works. It is the policy of the Grand Trunk's present management to use only Canadian-built engines on its Canadian lines. These are declared by W. Kennedy, mechanical superintendent of the road, to be carefully and strongly constructed, and to be admirably adapted for service on roads in the Dominion.

A $45,000 maternity hospital is being built at Edmonton.

The Ingersoll Nut Co. are building a new factory in Ingersoll.

A deposit of coal has been discovered near Okanagan Lake, B.C.

A $50,000 public school will be erected in the south end of Calgary.

David Booth, of Brockville, will build the $70,000 armories at Guelph.

The Brantford Screw Co. proposes to double the size of their factory.

The new factory of H. K. Wampole & Co., Toronto, is progressing well.

The Hall-McNab Co. will build a $10,000 flour mill at Red Deer, Alberta.

The Bank of Montreal are erecting a $30,000 business block at Lethbridge.

An engine house is to be erected at Pictou by the Intercolonial Railway.

Wm. Hendrie, Hamilton, is building a concrete block residence in Hamilton.

Extensive improvements are to be made to the Russell House in Ottawa.

The steel work on the new bridge at Ferry Point, N.W.T., is now completed.

A new railway station is to be built at Charlottetown, P.E.I., for the I.C.R.

Work has been commenced on the new $40,000 normal school at Killarney, Ont.

Work on the $12,000 C.P.R. freight sheds in Moose Jaw has been commenced.

The large grain elevator of Green Bros., at Harrow, Ont., has been burned.

It is proposed to erect a smelter at Princeton, in the Similkameen district, B.C.

Iron ore has been found at Temagami on ground owned by J. B. Caldwell, M.P.

The Brackman -Ker Milling Co. are erecting a large grain tank at Strathcona.

The Brantford Electric & Operating Company are installing a new steam plant.

The Canada Permanent Mortgage Co. are going to erect a business block in Regina.

J. M. Griffin & Co. are building a new warehouse on Railway street, St. Thomas.

The Estevan Grain Co., Estevan, Man., are erecting a new 30,000-bushel elevator.

The machinery is being installed in the plant of the Brantford Gas Co., Brantford.

Kelly, Douglas & Co., Vancouver, are to spend $75,000 on a new eight story warehouse.

The Dominion Copper Co., Vancouver, will blow in another idle smelter in a few weeks.

Kelly & Mitchell are to erect a marble bank building at Winnipeg for the Bank of Toronto.

The new rails on the Pere Marquette have been laid from Cedar Springs to Kemptville.

W. A. Inglis has installed a new Gyrator system in his flouring mills at Owen Sound.

Some fifty town lots have been sold at Cobalt, Ont., at prices ranging from $250 to $710.

Wm. Lyal is contemplating the erection of a ten-storey hotel in Winnipeg to cost $750,000.

The development of Regina is shown by the great number of new buildings going up there.

The large saw mill at Fay Settlement, N.B., owned by S. McNutt, has been destroyed by fire.

A granite cutting industry has been established at Rock Island, Quebec, by John C. Lacasse.

A representative of an American churn company has been looking for a factory site at Brantford.

J. Tompkins has about completed the construction of the C.P.R. roundhouse at Westmount, Que.

J. H. Harris & Co., Moncton, N.B., are erecting a large new concrete construction warehouse.

The Point Douglas avenue Presbyterian church, Winnipeg, are erecting a new stone and brick church.

Aikins & Pepler are erecting a combined business and apartment block on Osborne street, Winnipeg.

The Dominion Copper Co. expect to build a new smelter in the Boundary district in British Columbia.

The contract for the erection of the wholesale fish warehouse of W. J. Guest, Winnipeg, has now been let.

A. F. Anderson & Co., implement dealers, Winnipeg, are erecting a track warehouse on Henry avenue.

The Pittsburg Coal Company's new docks at Port Arthur are to have a capacity of over 1,000,000 tons.

E. H. Briggs & Co., broom manufacturers, Winnipeg, will erect a large factory on Henry street this year.

Fire did $100,000 damage a few days ago to the wash plant of the Dominion Coal Co., at Port Morien, N.S.

Sample goods have been turned out by the Brass Foundry at Wallaceburg, and are apparently very satisfactory.

Plans have been prepared for a new G.T.R. station at Brampton. The building will be granite and red brick.

Swan, Church & Co., Montreal, are executing the expanded metal work in the new Mount Royal Club, Montreal.

The Nova Scotia Steel & Coal Co., Sydney, N.S., have their blast furnace and open hearth plant in full operation.

C. A. Cyphers, incubator manufacturer, Buffalo, is considering the establishment of a branch factory at Berlin.

The Canadian Northern Railway plan to build a hotel, depot and general office building at Winnipeg to cost $2,500,000.

Plans are under way for the erection of buildings for the construction and repair of cars for the I.C.R. at Moncton.

The Dominion Government has appointed experts to investigate the character and extent of the zinc deposits in B.C.

The Western Commercial Co. have commenced building operations on their property on 20th street in Riversdale, N.W.T.

The Robb Engineering Co. are building two 200 horse-power Robb-Mumford boilers for the Cumberland Railway and Coal Co.

The works of the Canada Saw Works at Ottawa have been closed and the plant and machinery will be removed to Montreal.

The American Radiator Company has placed $15,000 insurance on the Cock-

shutt buildings being bought by them at Brantford.

Work on the railroad tunnel which is to be constructed under the Detroit River between Windsor and Detroit has been begun.

Wm. Grace & Co., Winnipeg, have secured the contract to build the new town hall at St. Boniface, Man., the price being $33,801.

Contracts were let this week for the construction of buildings for the new sheet steel and tin plate mills at Morrisburg, Ont.

There are several new buildings yet to be started in Fort William this Fall, chief of which is the large addition to Avenue Hotel.

Heavy shipments of freight consigned by eastern factories to agents and firms in the Yukon are passing through Winnipeg at present.

The Alberta Building Company has secured the contract to build the new 150,000-bushel elevator for the Calgary Milling Company.

The Manitoba Brewing Co., Fort Rouge, will begin the erection of an ale and porter brewing house and bottling works very soon.

It is expected that eleven miles of the Elbow and Moose Jaw branch of the C. P.R. will be completed by the time the crop is ready to move.

Tests are now being made in Victoria, B.C.. by Prof. T. S. Lowe, to ascertain whether the Vancouver Island coal is suitable for coke making.

The site for the factory of the Dominion Thread Mills in Stratford has been selected, and the building will be commenced very shortly.

The factory buildings of the Plymouth Cordage Co., Welland, will be located at the Michigan Central station, and the warehouses on the canal.

The Granby Consolidated Co. have completed the purchase of the Gold Drop group of claims in the Phoenix camp, B.C., for $250,000.

The Canadian Sand and Lime Brick Co., Toronto Junction, have installed their large new engine and boilers in the new works on Syme's road.

The Georgian Bay Engineering Works, Midland, are installing in the carriage plant of T. H. Crowe, Toronto, a 16-horse-power gasoline engine.

It is stated that the Grand Trunk have plans prepared for improving traffic facilities at London, which will mean the expenditure of $2,000,000.

The new concentrating plant at the Brittania Copper Mine, Howe Sound, B.C., is ready to start. Two hundred tons of copper ore are mined daily.

The contract for the erection of the new C.P.R. station at Medicine Hat has been awarded to Jas. McDiarmid, Winnipeg, the price being about $2,000.

R. J. Geddes, Sixth avenue, Vancouver, B.C., is going to erect a $2,300 frame residence; J. H. Geatrix, Fifth avenue, is going to build a $2,000 residence.

In order to establish a branch stove foundry at Vancouver the Record Stove Foundry of Moncton, N.B., proposes to increase its capitalization from $800,000 to $1,000,000.

The Imperial Cement Co., Montreal, P.Q., is equipping itself with a Sturtevant pulverized coal burning apparatus, supplied by the B. F. Sturtevant Co., of Boston, Mass.

Pilkington Bros., Limited, glass manufacturers, St. Helens, Lancaster, Eng., are at present building a fine warehouse in Winnipeg on the corner of Louise and Market streets.

Seattle capitalists propose to build two large sawmills on the west coast of Vancouver Island, one at Mosquito Harbor, Clayoquot Sound, and the other at Nootka Sound.

The Ladysmith (B.C.) Iron & Stove Works are receiving many orders for stoves from the mainland, and a number of fresh hands have been put on to cope with the orders.

King Bros., Ltd., tanners, Whitby, are enlarging their works by the erection of a large leech house, 60x75 feet and three stories high. Much new mgchinery is also being installed.

Work is progressing rapidly with the construction of the concrete piers for the Battle River bridge, the contractor, Mr. Foley, of Ottawa, having nearly fifty men at work.

Extensive plans for the improvement of the system of lighthouses along the Atlantic seaboard of Canada are announced by J. F. Fraser, of the Marine Department at Ottawa.

Adams Bros., of Winnipeg and Toronto, have a gang of men tearing down the old buildings at Moosomin preparatory to the erection of a fine new block, 54 by 60 feet, two storeys.

The Colonial Portable House Company, Ltd., has been formed at Vancouver, capitalized at $10,000, to manufacture portable houses patented by Archibald Rowan, Vancouver.

A start will soon be made on three new buildings in Guelph. These are the new C.P.R. station, $40,000; the Homewood Sanitarium additions, $100,000; and the Armoury, $100,000.

The W. G. Grace Co., of Chicago, have secured the contract for all concrete work, foundations, etc., for Sir William Macdonald's Agricultural Farm building at Ste. Anne de Bellevue, Que.

The building for the Acheson Graphite Works in Welland is rapidly assuming shape. It is expected the machinery will arrive the first part of October, when operations will soon begin.

The work on the new lighthouse at Burlington Beach, Hamilton, has been commenced. A concrete base will first be laid, and on that will be erected the steel structure of the lighthouse.

Native silver in thread formation has been found near Carcross, in the Yukon district, in rock that runs $1,100 to the ton. The owners of the find are preparing to expend $200,000 in developing.

The Western Electric Co. proposes to erect a factory 50x200 feet at Waterloo if the town guarantees their bonds for $16,000 for 20 years. Electric meters and trunk finishings will be manufactured.

Ald. Edward Cook, Vancouver, is building a $30,000 warehouse on Water street in that city. Pither & Teiser, liquor wholesalers, Victoria, are also erecting a three-story warehouse in Vancouver.

John Crerar, of Chicago, has let the contract to F. Doherty for the erection of a business block on Simpson street, Fort William, 75x50, solid brick, two stories, and a modern building in every respect.

Six carloads of bridge material are being forwarded from Amberg, Pa., via Vancouver, to Dawson for the construction of the Klondyke Mines Railway bridge across the Klondyke river at Dawson.

Hon. Mr. Emmerson has been authorized by the Government to purchase forty new locomotives for the Intercolonial Railway. The understanding is that they are to be purchased from Canadian firms.

Plans and specifications for the first 80 miles of the Lake Superior branch of the transcontinental railway are now on exhibition in Montreal, and contractors will be allowed 30 days in which to submit tenders.

A large aerated water factory has just been completed for the Gooderham firm at York Mills, and the installation of the machinery is in progress. It is expected that manufacturing will begin in a few weeks.

The largest shipment of steel by the Dominion Iron & Steel Co. was made last Friday, when twenty-nine cars, amounting to about 1,500 tons, were shipped to Montreal and upper Canadian markets from Sydney.

Building activity is showing no signs of slowing up in Winnipeg at the present time. The number of permits being issued daily still indicates that the present year is to be a record one for building operations in the city.

Messrs. F. F. Powell & Co., Montreal, have completed the contract which they have carried on for the past twelve months on the Royal Mills, grain elevators, conveyors, flumes, etc., for the Ogilvie Flour Mills Co.

The Dominion Government has placed an order with the Dominion Iron and Steel Co. for the supply of 25,000 tons of 80-pound steel rails for use by the Intercolonial Railway. The contract calls for immediate delivery.

The Canadian Westinghouse Co. of Montreal has been awarded the contract for the installation of a 1,500 k.w. steam turbine for the Ottawa Electric Co. The turbine will be the largest placed by the company in Canada.

The new lathe shop of the Latrobe Steel Co., Latrobe, Pa., containing nearly three-quarters of a million cubic feet of space, is to be heated by Sturtevant hot blast system, installed by the B. F. Sturtevant Co., of Boston, Mass.

Mr. S. L. E. Cuddy, St. Lawrence street, Montreal, has purchased, through Messrs. P. S. Ross & Sons, the property at 295 St. Lawrence street and along De Montigny street to and fronting St. Dominique street, for $28,000.

The Dominion Government has received a reply from the Imperial authorities in answer to the request to remove the embargo on Canadian cattle. The British Government, on a report of the British Board of Agriculture, has declined to do so.

The Lehigh Portland Cement Co., Allentown, Pa., have purchased 10,000 acres of limestone and clay lands lying east of the Belleville Portland Cement plant. This company will erect next Spring a plant of 4,000 barrels per day capacity.

The James Smart Manufacturing Co., Brockville, are installing the Kelsey warm air generators in the fol-

lowing schools: Public School at Elknorn, Man.; Public School at Wawanesa, Man., and the Caroline Street School, Hamilton.

The Queen Mine at Ymir, B.C., purchased recently by Wm. Waldie for $50,000, has been bonded to C. F. and R. J. Doyle, Chicago. The bond calls for the payment of $100,000 within 12 months, $20,000 of which is to be paid by September 10.

The box factory of the British Columbia Box and Lumber Co., Vancouver, has been purchased by J. Hanbury, a prominent Brandon lumberman. Mr. Hanbury is also contemplating the establishing of flour mills and elevators in Vancouver.

The W. G. Grace Co. have sub-let the expanded metal lathing and partition work required in Sir Wm. Macdonald's Agricultural College to the Clinton Fireproofing Co., of Montreal. This firm are using Pedlar's Perfect lathing on this work.

The Winton Automobile Co., Cleveland, have purchased property on Richmond and Victoria streets, Toronto, on which a large three-storey automobile repair shop and showrooms will be erected. Building will be commenced by September, it is said.

The Fairbanks-Morse Co., Chicago, have the contract for the construction of new coal sheds and the installation of the coal handling machinery for the Dominion Coal Co. in Prince Edward Island. The driving machinery consists of two 50 h.p. engines.

The National Construction Co., who, it is announced, will be the principal contractors of the Grand Trunk Pacific Railway from Winnipeg to the Pacific, is made up of interests connected with the Grand Trunk Pacific Railway and the Grand Trunk Railway.

The Hydro-Electric Commission, which is composed of Hon. Mr. Beck and Messrs. P. W. Ellis and George Pattinson, M.P.P., has handed in its report to the Government on the application of the municipality of Kenora to utilize the water-power of the vicinity.

The B. F. Sturtevant Co., of Boston, Mass., has secured the contract for the forge shop equipment of the Springfield Technical High School, Springfield, which will consist of over 20 forges, with blower for furnishing blast and exhauster for removing the smoke.

The Superintendent of Mines, Dr. Haanel, has just completed the organization of a party that will shortly leave for British Columbia to investigate and report upon the extent of the zinc deposits of that Province. W. R. Ingalls, M.E., editor of Mining Review, will have charge.

J. S. Longhead & Son, Sarnia, Ont., manufacturers of bent woodwork for carriages, sleighs, etc., are adding materially to the handling capacity of their plant. They are erecting new buildings aggregating 800 feet in length for storage purposes for both the raw material and the finished product.

The Western Canada Milling Co., Montreal, have let the contract to Jas. Stewart & Co., Pittsburg, for the erection of a flouring plant in Montreal to cost between $550,000 and $600,000. The buildings will be concrete-steel construction, and the plant will have a capacity of 5,000 barrels per day.

Messrs. Nagle & Mills, of Ingersoll, have secured the contract for the erection of the new factory for the Ingersoll Nut Co., at $9,250, which is $1,250 more than the cost of the building originally contemplated in the agreement in connection with the by-law granting a loan of $20,000 to the company.

Mr. D. H. Ross, Canadian agent in Melbourne, has cabled to the Department of Trade and Commerce that the Commonwealth Government had decided to re-enact the law adding the inland freight charges on goods from Canada and the United States to all invoices of shipments destined for Australia.

The Canadian Tunnel Co. and the Michigan Tunnel Co., the two companies chartered to build the tunnel under the Detroit River, have combined under the name of the Detroit River Tunnel Co. The new company is capitalized at three millions, a merely nominal one, as the work will cost not less than ten million dollars.

The Nova Scotia Steel & Coal Co. has just made a large contract with the Montreal Sugar Refinery for 25,000 tons of picked coal as a first instalment. The company expects to be raising coal at the new colliery in a few weeks. It is expected that the company's total output for 1905 will be the largest in its history.

A congratulatory banquet will be tendered President W. K. George, of the Canadian Manufacturers' Association, by the Montreal branch of the association, on the evening of Saturday, Sept. 16th next, in recognition of the way in which he presented the views of the Canadian manufacturers during the recent British tour of that body.

One important use for compressed air is in the operation of quarries. Messrs. Kelly Bros., of Winnipeg, have just purchased from Allis-Chalmers-Bullock, Limited, Montreal, six Haeseler pneumatic hammers for dressing stone. These will be operated by an Ingersoll-Sergeant air compressor, class E, driven by a 25-horse-power induction motor.

Until Spring, or such time as the Legislature makes new regulations, no more patents for mining claims in Coleman, Bucke, Lorrain and Hudson Townships will be issued by the Ontario Government. In the menatime, however, prospecting may go on and when the new regulations come in force priority will be given to claims in the order filed.

The Nova Scotia Coal and Steel Co. have now on their pay roll 2,200 men whose monthly wages amount to over $130,000. Up to the present this season the mines have had an output of over 250,000 tons of coal or at least 150,000 tons over the corresponding period last year. Most of the coal this season has been shipped to the St. Lawrence market.

It is claimed that one of the plans now under consideration by the Lake Superior Corporation is the opening of the nickel reduction works. It has been stated that a deal had been made whereby this plant had been leased for $60,000 a year, but the story was denied. It was admitted, however, that a deal was on and might be consummated at any time.

New tenders are being called for by the Public Works Department for the Implement building for the Ontario Agricultural College at Guelph, and the cottages to be erected there. The appropriation for the building is $25,000, and for the cottages $3,000, and the former tenders so greatly exceeded these amounts the Minister decided to ask for others.

The London Tool Company have awarded the contract for the framework of their new building, but whether it will be built in London or Hamilton remains to be determined. The framework is of steel, and may, of course, be placed anywhere. It will have dimensions of 110 feet by over 300 feet, so that the importance of the works may be readily estimated.

The Brandon Binder Twine Co., Limited, Brandon, have gone out of business, and before the end of September the entire plant will be advertised for sale by tender. The cause of this is the directors not wishing to raise more capital, which would be necessary for the carrying on of the business, because of the forced condition of the binder twine trade.

The contract for the erection of a new steel business block at Forest has been awarded to C. McLean and N. McCordic. The new building will be two stories high, and will be built of cement blocks. It will be occupied by the Arcade Hardware and other stores. The cost will be about $8,000. The cement blocks will be furnished by the Forest Cement Building and Construction Co.

The Dominion Iron & Steel Co. has an average daily output for the past three months from the open hearth furnaces of 450 tons of steel, of which about 350 tons have been used in the rail mill since it started. The rest went to the billet mill. One day last week the record output of 670 tons was made. It is said that the company may have a plate mill in operation next year.

New uses are being found for nickel in a variety of industries, and its possibilities are only just beginning to be appreciated. The British Government have been considering the question of employing it for coins, as is done in many continental countries. Arrangements have already been made for nickel coins to be circulated in one of the colonies, and they will be ready for issue in a short time.

The Plymouth Cordage Co. are preparing to erect their plant for the manufacture of binder twine at Welland, Ont. Building operations will be commenced in the Fall. The plant will employ 500 men, and Frank Holmes, assistant treasuerer of the company, will be Canadian manager. The company have already contracted with one of the power companies for 1,200 h.p. The American plant of the firm is at North Plymouth, Mass.

The Westinghouse interests have bought a site on the Niagara frontier, on which they will build a great plant for the manufacture of electrical machinery. The site selected is on the Niagara gorge, below Niagara Falls, on a table land near the historic Devil's Hole. The Ontario Power Company's transmission line crosses the Niagara river at that point. The power company is said to be associated with the Westinghouse people in the deal.

The Western Canada Cement & Coal Co., London, England, has authorized applications for £2,250,000 of first mortgage bonds at par to be supplied in acquiring cement, clay and anthracite coal lands at Kananaskas, Alberta, in

erecting a portland cement factory and for working capital. Besides this is contemplated the building of 300 to 500 elevators throughout the Northwest, equipped with the latest appliances and with a capital of from ten to twelve million dollars.

Among the recent sales of Allis-Chalmers-Bullock, Limited, Montreal, are a mining outfit to the Canada Metal Co., Ainsworth, B.C., including one 15-horse-power vertical boiler, one 40-horse-power vertical boiler, two No. 5 Cameron sinker pumps, one $6\frac{1}{4}$x8 in. hoisting engine, one 7x10 hoisting engine, ore buckets, etc., and to the Souris Coal Mining Co., of Bienfait, Assa., one 75-horse-power Lidgerwood hoisting engine of the combined friction drum and brake and reversible link motion type.

After all is said, the removal of the bounty on steel rails will not so seriously affect the producers as was at first supposed. As a matter of fact, the bounty, owing to the sliding scale adopted when the bounty was introduced, amounted this year to only $1.65 a ton, and not to $3, as was generally thought. It is not the same bounty that is paid on finished steel. So far, at least, as the Dominion Iron & Steel Co. is concerned, the removal of the bounty simply reduces the protection from $11.40 to $9.75 per ton.

Copper refined in Canada is now being sent forward to China to be used in connection with the coinage of that country, one shipment of 100,000 pounds having gone forward, while another of 50,000 is about to be made. There is at present only one copper refinery in Canada. The Montreal Copper Co. now have a ten-ton-a-day plant in operation, and while it is not yet much of a factor in copper production, the management state that they have been able to compete against the copper trust in the United States, and will grow.

By the recent purchases of adjoining properties, the Granby Consolidated Co. have increased their holdings in the Boundary district at Phoenix, B.C., to about four times its original area. The properties added are those of the Gold Drop Mining Co., which includes the Gold Drop, the Gold Drop Addition Fraction, the Phillipsburg, and Nugget claims. This property has been under option at $250,000 for some months, during which time it has been exhaustively tested by drill holes, which have disclosed a deposit similar to that already developed on the Knob Hill and Old Ironsides.

The contract for the complete construction of the roadbed ready for ties and rails upon that section of the Grand Trunk Pacific Railway from Portage la Prairie to Touchwood Hills, N.W.T., 275 miles, was awarded last week at the office of Mr. Frank W. Morse, Montreal, to the McDonald, MacMillan Co., of Westbourne, Man. This does not include the construction of the steel bridges. The successful firm is a purely Canadian organization, well and favorably known in the Northwest. The contractors' figures for the work are variously estimated from between $3,000,000 and $3,500,000.

Experiments in electric smelting, which are to be conducted at Sault Ste. Marie, will be commenced in about two months. Mr. Herault of La Praz, France, inventor of the Herault system of smelting by electricity, will come to Canada to give the Government the benefit of his advice. Investigations so far made into the electric system of smelting and the valuable report published on the subject under the auspices of the Canadian Government have attracted world-wide interest, and no less than 2,500 commendatory letters from all quarters of the habitable globe have been received by Dr. Haanel, Superintendent of Mines.

Plans are at present under way for the construction of a large machine shop for the Grand Trunk at Mimico. There is already a roundhouse and small shop built there. It is proposed to move the shops from their present position at the foot of Spadina avenue, Toronto, out to Mimico in order to leave more space for yards. No erecting shop is being allowed for at Mimico, and from that it would appear that no engine that cannot be repaired in the roundhouse will be sent to the Mimico shops. In that case the shops there will be engaged almost entirely on track work, and possibly the Grand Trunk may be in the market for additional rail planers.

The Canadian Copper Co., who have within the past two years spent $2,000,000 on plant and betterments in connection with their nickel mines near Sudbury, have about completed arrangements for the sampling and purchase of the refractory and valuable ores of the Cobalt district. A crusher is being erected at Copper Cliff, the smelter town of the company, a skilled chemist from New York is to be engaged, and the cobalt ores will be purchased on the plan in vogue at Denver, Omaha and other mining centres in the west. An umpire will be chosen in case the chemists for buyers and sellers differ as to value, and on the certificate of this umpire payment will be made.

According to a Pittsburg report, the billion-dollar steel trust has obtained possession of a club that will be of great assistance to beat competitors in the armor plate business into submission. Andrew F. Mitchell, employed in the armor plate department of the Carnegie Steel Co., Homestead, has been granted a patent on an improved process for armor plate manufacture. The principal cost in making armor plate is in heating the billets for pressure into shapes, and the annealing and carburizing. By the Mitchell process the cost of manufacture is said to have been reduced 50 per cent., while the plates are stronger and can more readily be machined, after being annealed and carburized. The trust will exploit the patent and the independents are described as being uneasy at the turn of affairs.

The Lake Superior Corporation, operating the Sault rail mills and furnaces, have awakened to their need of iron ore, and are now about to carry on explorations at various points in Ontario, where there have been sufficient indications to warrant expenditure. This is a pretty wide field, running from east of Michipicoten to west of Thunder Bay, and for a time the work will be in the nature of reconnaissance, though at some points the company have faith that they can quickly get at good ore. Algoma, or Western Ontario, has been merely scratched by the prospector, and it would appear that with the extensive and energetic work that has been done on the American side there would be important results, especially as there are indications galore. This work will doubtless be under charge of A. B. Willmott, whose knowledge of the region is not surpassed.

All mining explorations that have been under way in the vicinity of Loon Lake have ceased for the present and the efforts of the owners of the properties explored are now directed toward selling their holdings. Wiley Bros., of Port Arthur, who are leading owners in these developments, state that they have very rich finds but the general mining public is inclined to doubt this. Just now experts for the Jones & Laughlin Steel Co. are on the ground making preliminary examinations. There has been some diamond drilling with considerable pitting by the original explorers, and newspapers of the district have had much to say of results, but this sort of information is notoriously unreliable. The Government drill is now on some property of R. H. Flaherty, who has been connected more or less with iron explorations for some years, but this week the drill is idle. These finds lie on the south side of Loon Lake, and about three miles from Lake Superior, 25 miles east of Port Arthur, and if valuable are certainly well located for prompt and cheap shipment.

Order for Big Turbine.

The Canadian Westinghouse Company, of Montreal, has been awarded the contract for the installation of a 1,500 k.w. steam turbine for the Ottawa Electric Company. Work of installation will be carried on during November.

The steam turbine is known as the Westinghouse-Parsons type, and is manufactured at Pittsburg. The company is completing the installation of other turbines, which makes four it has placed in the Dominion, one in Montreal for the Northern Electric Company, of 300 k.w.; one at Belleville for the Portland Cement Company, of 400 k.w.; one of 500 k.w. for the C.P.R. plant at Fort William, and one of 400 k.w. at Dawson City. The turbine at Ottawa is, therefore, easily the largest placed by this company in Canada.

Bounty to Ship Builders.

The Glasgow Herald publishes an editorial in its issue of August 30th, in which the opinion is expressed that, in the event of Canadian manufacturers of steel rails either diminishing or suspending their output of steel rails on account of the $3.00 per ton bounty being remitted, a great quantity of pig iron will find its way to the British shores. Furthermore, the steel companies may turn their attention to ship building, and a bounty to ship builders may be given for the purpose of restoring an industry once renowned in Canada.

New Machinery Firm.

A new firm of mechanical engineers and machinery merchants has been established at Montreal to be known as McLean & Sophus, with office at 301 St. James street. The firm will carry on the regular business of consulting engineers, paying particular attention to reduction gearing and to adjusting machinery.

Mr. McLean is a graduate of McGill University, class of '99, and obtained the 1851 scholarship, which entitled him to a course abroad. Since the comple-

tion of this course, he has been chief designer for a well known firm in Manchester, Eng., and now comes back to the land of his birth to engage in business on his own account.

Mr. Sophus is a native of Denmark, and was in England for six years, with a large firm manufacturing electric wire and tape. He will attend to the electrical engineering and business end of the firm's affairs.

McLean & Sophus are Canadian agents for several well-known English firms, among them being: Richard Davies & Sons, Manchester; David Brown & Sons, Lockwood, Huddersfield; Newall Engineering Co., Warringtoni; and A. G. Thornton, manufacturer of drawing instruments, Manchester.

* * *

Below will be found a list of Canadian patents recently secured through the agency of Messrs. Marion & Marion, patent attorneys, Montreal, Canada, and Washington, D.C. Information relating to any of these will be supplied free of charge by applying to the above-named firm: 94,067, John Crozier, Ste. Agathe (Lotbiniere), Que., railway rail chair; 94,074, Wm. N. Garrett, Amherst, N.S., door guide bracket; 94,109, Gustave Gin, Paris, France, process for the electrometallurgical manufacture of metals or alloys free from carbon; 94,119, Frank C. Buck, Prahran, Victoria, Australia, valves and cocks; 94,132, Daniel Carpentier, Paris, France, method or process for lubricating with a continuous circulation and a partial recovery of the lubricant; 94,250, George Bryan, Clarenceville, Que., mud and dust guard; 94,254, Leon D'Amour, Trois Pistoles, Que., improvements in vehicles; 94,259, George P. Johnston, Hamilton, Ont., cream separator; 93,501, Hermann Blau, Augsburg, Germany, method of treating distillation gases to obtain an illuminating gas in a highly compressed form suitable for transport; 93,513, Leon Ernest Lachat, Lyon, France, trucks or trolleys with sliding steering wheels; 94,278, Charles F. Rockstroh, Brooklyn, N.Y., printing plate holders; 94,303, Thomas Edwards, Ballarat, Victoria, Australia, mechanically rabbled ore roasting furnaces; 94,324, Alexandre Jacob, Vilvorde, Belgium, disincrustant for steam generators; 94,459, Eugen Fullner, Silesia, Germany, drums for drum filters; 94,522, Messrs. Elixman, Cunningham & Shevlin, Corinth, N. Y., cores for paper rolls; 94,654, Thomas P. Rudkins, Mitiamo, Victoria, Australia, means for moving goods.

BOOK REVIEWS

"Producer Gas," by A. Humboldt Sexton, F.I.C., F.C.S., Manchester, the Scientific Publishing Co., price ten shillings, net.

The production of this volume is the outcome of a series of lectures given by the author on "Producer Gas" at the Technical College, Glasgow. This volume treats in a comprehensive manner with the qualities of gas and its action, describing the different kinds of gas produced for industrial purposes. The matter of producers is taken up and discussed at some length in conjunction with the different gases to which they are adapted. The matter of cost is also dealt with. The book ends with a description of some of the most improved gas producers.

"Concrete, Plain and Reinforced." By Frederick W. Taylor, M.E., and Sanford E. Thomson, S.B., New York, John Wiley & Son.

In this book the materials, construction, and design of concrete and reinforced concrete are dealt with. In addition to the author's work, chapters are included by R. Feret, William B. Fuller, and Spencer B. Newberry. It is designed for the use of practicing engineers and contractors as well as a text and reference book for concrete and engineering students. It contains 585 pages and is copiously supplied with illustrations, diagrams and tables. In order that the reader may become fully familiar with the subject under discussion, the opening chapters deal with definitions of the different terms used. In the second chapter is given an elementary outline of the process of concreting, which is followed by chapters on specifications, the choice of cements and its classification, chemistry and special tests with the material, strength and composition, followed by a full discussion of the subject of reinforced concrete in its different applications, together with other information regarding the different processes of manufacture.

"Dimensions of Pipe Fittings and Valves." Second edition. By W. D. Browning, Cleveland. The Browning Press.

This is a practical book, well filled with sketches, diagrams and illustrations, together with tables and other valuable information regarding the subject mentioned. References are made in it to sources of more detailed information on the subject. This is the book that every plumber and steamfitter and engineer should have, as not only will its perusal increase his practical knowledge, but will give him a better insight into construction details of the materials he uses.

"Mechanics of Air Machinery," by Mr. Julius Weisbach and Gustav Herrmann, translated by A. Trowbridge, Ph.D., Adjunct Professor of Mechanical Engineering of Columbia University, New York, D. Van Nostrand Co., price $3.75 net.

Since the application of air machinery to the industrial arts is coming into such common use and is playing such an important part in manufacture and mining, a volume dealing with the subject in a theoretical and descriptive manner as this is most opportune, and to those interested in the theoretical side of air machinery it is full of information derived from research and mathematical formulae. It takes up the designs of air-moving machinery to meet modern conditions.

"The Steam Engine and Other Steam Motors." By Robert C. H. Heck, M.E., Assistant Professor of Mechanical Engineering Lehigh University, New York, N.Y., D. Van Nostrand Co., 391 pages, price $3.50.

This is volume one including the thermodymanic and the mechanics of the engine. It is complete in two volumes and is intended as a text book for engineering colleges, and a treatise for engineers. As explained in the preface, the object of the book is to set forth clearly the fundamental principles of the steam engine, to give a broad description of construction practice, to explain fully the working of the machine in several departments, and to show how to find its efficiency in performance. The opening paragraph gives a general view of the subject, explaining the different parts and the principles and actions of the engine. In the second chapter the elementary thermodynamics of the heat engine is taken up, followed by the theory of the steam engine. The action of the steam in the engine, the dynamics of steam, the entropy-temperaturediagram, concluding with the chapter on the mechanics of the engine. An appendix gives tables for reference and notes on superheated steam. While to appreciate the book fully the reader must have a fundamental knowledge of mathematics, physics and mechanics, the subject is dealt with from most elementary principles, added clearness being given by many examples. Anticipated on what volume two may contain from the subject matter in the present volume, it is safe to predict that this book will become a standard for use by all interested in the subject of the steam engine and other steam motors.

"Electricians' Handy Book." By Prof. T. O'Connor Sloane, A.M., E.M., Ph.D., New York: Norman W. Henley Publishing Co., pocketbook size, 610 engravings, 768 pages, bound in red leather, gold titles and edges; price $3.50.

The tendency towards standardization and simplification of electrical apparatus, as well as the need of a practical book that could be understood by the student, the practical worker, and the everyday working electrician, and yet be valuable to the consulting electrical engineer, has led to the production of this book. Its reception is not for a moment in doubt, as it fills the place in electrical practice not covered by any previously published volume. The entire electrical field is covered in the most practical manner in forty-one chapters. The illustrations and diagrams are profusely used, thus simplifying the already clear and concise reading matter. It is the style of book that anyone desirous of becoming acquainted with the field of electricity would do well to procure, and at the same time its value as a book of reference is unquestionable.

ENGINEERING NEWS

AND BUSINESS NOTES

SOCIETY OFFICERS.

Canadian Society of Civil Engineers.

Officers for 1905: President, Ernest Marceau, Montreal; treasurer, H. Irwin; secretary, C. H. McLeod Rooms: 877 Dorchester St., Montreal.

Engineers' Club of Toronto.

President, R. F. Tate; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms: King St. W., Toronto.

Canadian Mining Institute.

President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Land, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Toronto Branch A. I. E. E.

Chairman, H. A. Moore; vice-chairman, R. G. Black; secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Association of Stationary Engineers.

President, W. A. Sweet; vice-president, Joseph Ironside, Hamilton; secretary, D. Outhwaite, Toronto; treasurer, A. M. Dixon, Toronto.

Ontario Association of Stationary Engineers.

President, F. W. Donaldson; registrar, J. G. Bain, 113 Yorkville avenue, Toronto.

Engineers' Society S. P. S.

President, J. P. Charlebois; recording secretary, E. C. Ash; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriss.

Technical Education.

From all accounts this year promises to be a record breaker in the technical schools and colleges in Canada; more students will attend the first year classes than formerly and preparations have been made accordingly. At the School of Practical Science, Toronto, a new building is in readiness that is a credit to the country and should do much to raise the standard of technical education in Toronto University. At McGill and Queen's additions have been made to the equipment and teaching staff and the same is true of smaller colleges as well, so that the outlook for the ambitious student of practical science is bright indeed.

Amalgamation of Engineers.

An important proposal has been made by President Lieb of the American Institute of Electrical Engineers, whereby he proposes a union of all the societies of professional engineers in the United States. The plan is to improve the civil, mechanical, electrical and mining engineering societies and will be in keeping with the spirit of Mr. Carnegie's idea when he donated a million dollars for the Union Engineering Building in New York. This is the same idea as is at present carried out in Canada, as all professional engineers are included in the Canadian Society of Civil Engineers.

Stationary Engineers' Convention.

The 18th annual convention of the Canadian Association of Stationary Engineers was held at Chatham, Ont., on August 22nd and 23rd, being marked throughout by the utmost harmony. At the opening meeting President Saulpthorpe referred in his address to the work of the association and spoke of the necessity of increasing the membership roll. He dwelt upon the necessity of the latter and that a legislative committee be appointed to draft a new bill with reference to a license law and to act in conjunction with the Ontario Association of Stationary Engineers to have it passed. The question of broadening the scope of the association was also dealt with and it was recommended that qualifications for membership be enlarged so as to include any British subject possessing the necessary qualifications. It is proposed to make the association one of the leading societies in the Dominion and the question of constituting a sick benefit to be controlled by the executive was dealt with. Further matters discussed were regarding having a board of examiners to grant certificates, cutting down per diem pay during the convention so as to allow the executive more funds to work on, a concerted union among stationary engineers to urge on the Ontario Legislature a license bill which had been applied for during the past session without success.

A clause well worthy of the association was included in the report of the committee on "The Good of the Order." It recommended that the association should at no time be used for the furtherance of strikes or in any way interfere between its members and their employers in regard to wages, recognizing the identity of interests between employer and employes and not countenancing any project or enterprise that will interfere with perfect harmony between them. Neither should it be used for political or religious purposes. Its meetings should be devoted to the educational, professional and mechanical knowledge.

The convention held was one of the most successful in the history of the organization. The officers elected for the ensuing year are: President, W. A. Sweet; vice-president, Joseph Ironside, Hamilton; secretary, D. Outhwaite, Toronto; treasurer, A. M. Dixon, Toronto; conductor, E. Grandbois; doorkeeper, Chas. Kelly; assistant secretary and official stenographer, H. E. Skelsey.

Mr. F. B. Uttley, representing Goldie & McCulloch, Limited, Galt, invited the association to hold their convention next year at Galt, where there were a large number of engineers. This invitation was accepted.

Hamilton Art School.

Active preparations are being made for the carrying on of instruction of machine design draughting, architecture, electricity, chemistry, and other technical subjects in the Hamilton Art School. The department of steam, machine design, mechanics, drawing, etc., is in charge of Mr. W. H. Raeburn. The school is being equipped with models and apparatus for the practical demonstration of the different subjects. The most up-to-date methods of teaching that can be found are being adopted. Mr. H. A. Neyland, a graduate of Pratt Institute, is the principal and through his efforts it has been raised to the position of one of the best schools in the Province.

Electric Power Districts.

The proposal made by the Ontario Power Commission to divide the Province into four electrical districts with the idea of selecting a water power in each district where electrical power may be produced and transmitted to all other points in the district should be carried out without any very great difficulty. The proposed centres of supply for the Province are Niagara Falls, the Chaudiere Falls at Ottawa, St. Mary's Rapids at the Soo, and Kakabeka Falls near Fort William. It is estimated that power from these centres can be transmitted for 200 miles and still be less expensive than steam power and the commission propose to secure the fullest information with regard to the cost of development, cost of transmission and price that would have to be charged consumers in order that a proper return may be made on the money invested. The object of the commission's report will be to supply information on which the Government will base its policy with regard to power development. It is said that the Government does not propose to go in for power development except as a last resort but will endeavor to intelligently govern and restrict the operations of private corporations, especially in the matter of rates.

Montreal Branch C.M.A.

The ballot for the election of officers of the Montreal branch of the Canadian Manufacturers' Association was concluded on August 25th. The result was as follows: President and chairman of branch, Lieut.-Col. Burland (acclamation); vice-president, Mr. D. Lorne McGibbon; members of the council, Messrs. J. H. Birks, S. S. Boxer, W. P. Coleman, C. W. Davis, J. S. N. Dougall, Geo. E. Drummond, Geo. Esplin, Col. Robt. Gardner, C. B. Gordon, J. T. Hager, Wm. MacMaster, Robt. Munroe, Clarence F. Smith, John D. Rolland, Ald. G. W. Sadler, W. T. Whitehead, David Williamson and J. J. McGill, ex-officio.

ABOUT CATALOGUES

Any Catalogue spoken of on this page will be sent upon request. Kindly mention Canadian Machinery.

Reynold Chain. The Link-Belt Engineering Co., Philadelphia, are issuing two little booklets descriptive of the Renold chain. One is a price list principally, while the other goes into the construction of the chain and explains fully the reasons for its efficiency.

Canadian Westinghouse. The Canadian Westinghouse Co., Hamilton, are sending out several circulars and booklets this month, among them being four instruction books, one on the installation and use of multiple alternating current arc lamps, one on the installation and operation of type 167A auto-starters for induction motors, one on the installation and operation of type R motors, and another on the operation of portable lamp testing wattmeters. There are also circulars on D.C. self-contained generators, and on type C.C.L. polyphase induction motors. There are also two little booklets on integrating wattmeters and multiple-alternating arc lamp system.

Induction Motors and Transformers. The Stanley A. J. Electric Manufacturing Co., Pittsburg, Mass., have recently gotten out two bulletins, one dealing with their type B.O. lightning transformers, and the other with single phase induction motors. The descriptive matter in both is complete and is well illustrated.

Water-Tube Boilers. The Canada Foundry Co., Limited, Toronto, are sending out bulletin No. 32, illustrating and describing the water-tube boilers manufactured by them. The bulletin is fully illustrated and the description is very complete.

"What Others Say" is the name of a catalogue issued by the W. G. Scale Co., 119-121 Mission street, San Francisco, Cal., containing reprints of articles which have appeared in engineering journals dealing with the Starrett system of pumping by compressed air.

Inter-pole Variable Speed Motor. Circular No. 14 of the Electro-Dynamic Co., Bayonne, N.J., is being sent out. It describes, illustrates and gives specifications of their inter-pole variable speed motor.

Induction Motors for Constant Speeds. Circular No. 200, issued by the Commercial Electric Co., Indianapolis, Ind., a bulletin describing and illustrating this type of motor which is being largely manufactured by the company mentioned.

Rock Drills. The Ingersoll-Sergeant Drill Co., 11 Broadway, New York, have issued a small booklet descriptive of their rock drills.

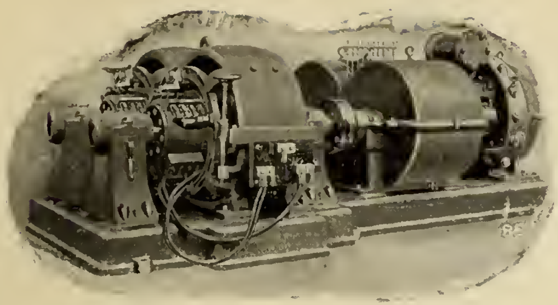
Coal Cutter. The "Radialax" coal cutter is well illustrated and described in a bulletin issued by the Ingersoll-Sergeant Drill Co., 11 Broadway, New York. The illustrations are of the different methods of cutting coal to which the cutter may be applied.

Valves. The Kerr Engine Co., Limited, Walkerville, Ont., have issued their catalogue of valves, including standard brass valves, globe, angle and check, as well as Jenkins disc, radiator valves, grease cups, straightway valves and hydrants.

Cutting Machines. A full list of hand and power cutting machines is described and illustrated in the handsome catalogue issued by the Oswego Machine Works, Oswego, N.Y. These machines are used by paper mills, paper dealers, printers, bookbinders, lithographers, box makers, wall paper manufacturers, textile workers, etc. The catalogue contains 34 pages. Size, 7 x 9.

CONTENTS.

DeLaval Steam Turbines



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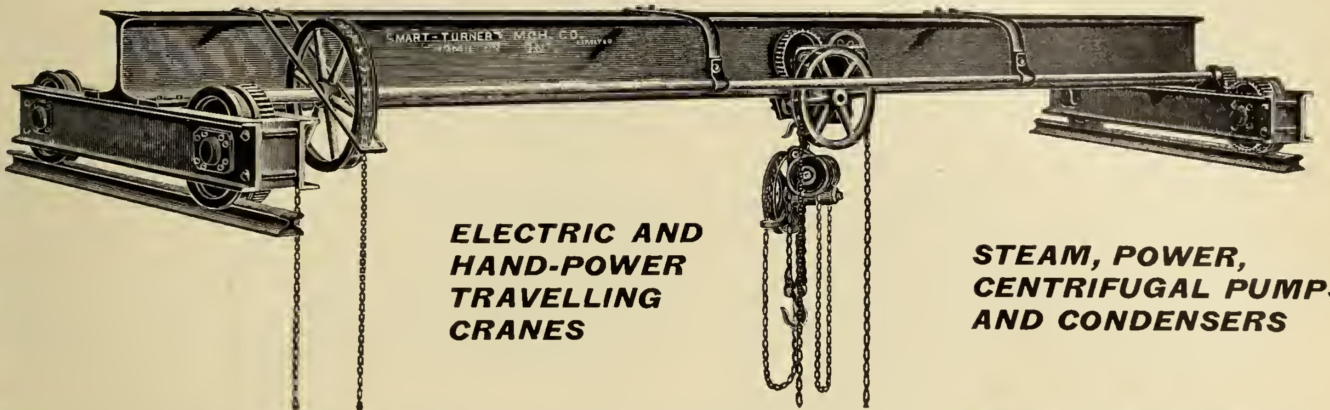

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To Owner
Cut Book 41
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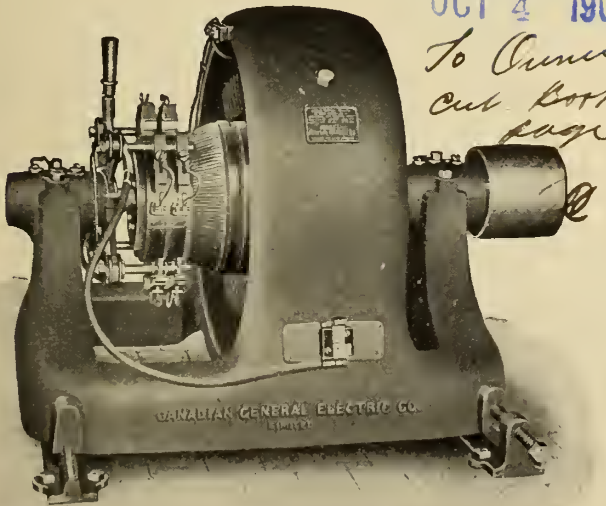

Good work cannot be done in the dark. If you need more light in your factory, we will be glad to give you an estimate on your requirements. Electric Light and Power Plants installed.

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MACHINERY BUYERS' DIRECTORY.

Readers of CANADIAN MACHINERY are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principa firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

Abrasive Materials.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Air Brakes.
Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Air Receivers.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Arbor Presses
Niles-Bement-Pond Co., New York.

Augers.
Chicago Pneumatic Tool Co., Chicago.

Axle Cutter.
A. B. Jardine & Co., Hespeler, Ont.

Axle Setter and Straightener
A. B. Jardine & Co., Hespeler, Ont.

Babbit Metal.
Cana la Metal Co., Toronto.

Barrels, Tumbling.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.
Niles-Bement-Pond Co., New York.

Batteries, Storage.
Chicago Pneumatic Tool Co , Chicago.

Bell Ringers.
Chicago Pneumatic Tool Co., Chicago.

Belting, Chain
Waterous Engine Works Co., Brantford.

Belting, Leather.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Sadler & Haworth. Montreal.
Williams & Wilson, Montreal.

Belting, Cotton.
Dominion Belting Co., Hamilton.
Sadler & Haworth, Montreal.

Belting Supplies.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.
Canada Machinery Co., Sarnia.
Chicago Pneumatic Tool Co., Chicago.
John Bertram & Sons Co., Dundas, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Benders, Tire.
Boynton & Plummer, Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.

Blowers.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass

Boilers.
Goldie & McCulloch Co., Galt.
Owen Sound Iron Works Co., Oweo Sound
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Boiler Plates
R. Sullivan David, Montreal.

Boiler Compounds.
Canada Chemical Mfg. Co., London, Ont.

Bolt Cutters.
National Machinery Co., Tiffin, Ohio.

Bolt and Nut Machinery.
A. B. Jardine & Co., Hespeler, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Books, Mechanical.
Technical Pub. Co., Manchester.
The MacLean Pub. Co., Ltd., Toronto.

Boring and Drilling Machines.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Co. Sarnia.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.

Boring Machine, Upright.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.

Boring Machines, Wood.
Chicago Pneumatic Tool Co., Chicago.

Boring and Turning Mills.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Box Puller.
A. B. Jardine & Co., Hespeler, Ont.

Bulldozers.
John Bertram & Sons Co., Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Cabinets, Tool.
Armstrong Bros. Tool Co., Chicago.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
Rice Lewis & Son, Toronto.

Calipers.
L. S. Starrett & Co., Athol, Mass.
Rice Lewis & Son, Toronto.
Williams & Wilson, Montreal.

Can Making Machinery
Canada Machinery Co., Sarnia.

Castings, Grey Iron.
Canada Machinery Co., Sarnia.
F. L. Hare Oshawa, Ont.
The Owen Sound Iron Works Co., Owen Sound.

Castings, Brass.
F. L. Hare, Oshawa, Ont.
The Owen Sound Iron Works Co., Owen Sound.

Castings, Steel
Ottawa Steel Casting Co., Ottawa.

Centering Machines.
John Bertram & Sons Co., Dundas, Ont.
Pratt & Whitney Co., Hartford, Conn.

Centres, Planer.
Pratt & Whitney Co., Hartford, Conn.

Chemicals
Canada Chemical Co., London.

Chucks, Ring Grinding.
A. B. Jardine & Co., Hespeler, Ont.
Chicago Pneumatic Tool Co., Chicago.
McLean & Sophus, Montreal.

Chucks, Drill and Lathe.
John Be tram & Sons Co., Dundas, Ont.
Ker & Goodwin, Brantford.
Krug & Crosby Hamilton.
A. B. Jardine & Co., Hespeler, Ont.
Jacob's Mfg. Co., Hartford, Conn.
McLean & Sophus, Montreal.
Mechanics' Supply Co., Quebec.
Niles-Bement-Pond Co., New York.
H W. Petrie, Toronto.

Chucks, Planer.
Francis Reed Co., Worcester, Mass.
McLean & Sophus, Montreal.

Chucking Machines.
American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Potter & Johnston Mach. Co., Pawtucket, R.I.

Circuit Breakers.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Clippers, Bolt.
A. B. Jardine & Co., Hespeler, Ont.

Compressors, Air.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Condensers
Smart-Turner-Machine Co., Hamilton.

Consulting Engineers.
Canadian White Co., Montreal.
Charles Brandeis, Montreal.
John S. Fielding, Toronto.
Roderick J. Parke, Toronto.
T. Pringle & Son, Montreal.

Contractors.
Canadian White Co., Montreal.

Controllers and Starters. Electric Motor.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock Co., Montreal.

Conveyor Machinery
Waterous Engine Works Co , Brantford.
Williams & Wilson, Montreal.

Coping Machines.
John Bertram & Sons Co., Dundas, Ont.

Cranes
Niles-Bement-Pond Co., New York.
Smart-Turner-Machine Co., Hamilton.

Crank Pin Turning Machines
Niles-Bement-Pond Co., New York.

Cotton Belting.
Sadler & Haworth, Montreal.

Cupola Blowers.
Sheldon & Sheldon, Galt, Ont.

Cut Meters
The Canadian Fairbanks Co., Montreal.

Cutters, Flue.
Chicago Pneumatic Tool Co., Chicago.

Cutters, Milling.
Becker, Brainard Milling Machine Co. Hyde Park, Mass.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Machines.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.
Hurlbut-Rogers Machine Co., South Sudbury, Mass.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Tools.
Armstrong Bros. Tool Co., Chicago.
H. W. Petrie, Toronto.
Mechanics' Supply Co., Quebec.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Dies, Opening.
W. H. Banfield & Sons, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.
W. H. Banfield & Sons Toronto.
Canada Machinery Co., Sarnia.
The Globe Machine and Stamping Co. Cleveland, Ohio.

Dies, Threading.
W. H. Banfield & Sons, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Draft, Mechanical
B. F. Sturtevant Co., Hyde Park, Man.

Drawing Instruments.
Mechanics' Supply Co., Quebec.

Drawn Steel, Cold.
Canadian Drawn Steel Co., Hamilton.

Drilling Machines, Arch Bar
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Co., Sarnia.

Drilling Machines, Boiler.
American Tool Works Co., Cincinnati.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
Canada Machinery Co, Sarnia.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Connecting Rod.
John Bertram & Sons Co., Dundas, Ont

Drilling Machines, Locomotive Frame.
John Bertram & Sons Co., Dundas, Ont

Drilling Machines, Multiple Spindle.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill & Tool Co., Cincinnati.
Canada Machinery Agency, Montreal.
Canada Machinery Co., Sarnia.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

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Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
King & Crosby, Hamilton.
London Machine Tool Co., London.
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.
Francis Reed Co., Worcester, Mass.

Drills, Blacksmith.
Francis Reed Co. Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.

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L. S. Starrett Co., Athol, mass.

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Wm. Abbott, Montreal.
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Drills, Horizontal.
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John Bertram & Sons Co., Dundas, Ont
Canada Machinery Agency, Montreal.
Canada Machinery Co., Sarnia.

Drills, Pneumatic.
Chicago Pneumatic Tool Co , Chicago.

Drill, Radial
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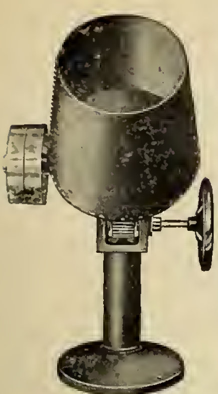

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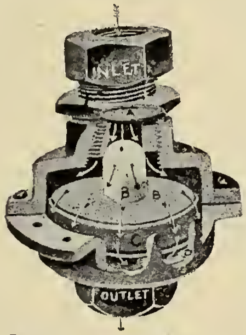

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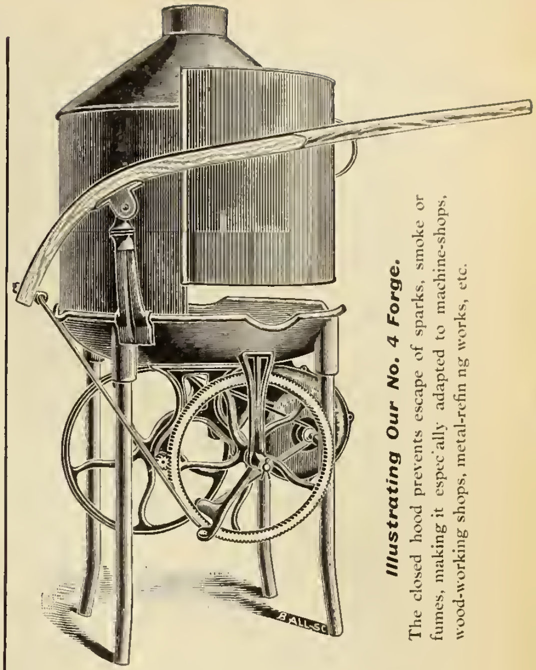

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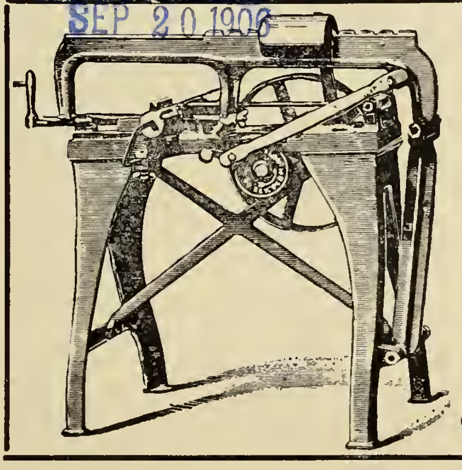

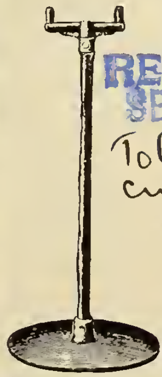

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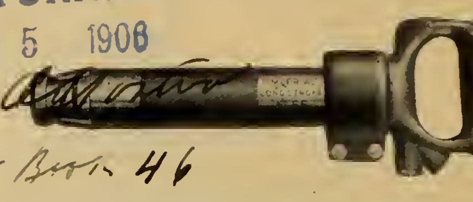

our Book 46

pg 23

THE RESULT

The leading manufacturers of pneumatic tools were invited recently to put their tools in the shops of one of the large bridge-building concerns in Canada, who were erecting a bridge five hundred miles from their shops.

The object was to determine which tool **could be relied on.**

After a thorough and exhaustive test, **IMPERIAL** tools were specified.

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SELECTED THE FOLLOWING FROM OUR STOCK OF . . .

SECOND-HAND—FINE CONDITION

Engine Lathes

10″ x 4′ Sebastian Foot Power and c. s.
13″ x 6′ Pratt & Whitney, with taper, R & F rest.
14″ x 6′ Bogert, R. & F. rest.
14″ x 6′ Flather, R. & F. rest.
14″ x 6′ Reed, R. & F. rest.
17″ x 6′ Gray, Plain rest.
18″ x 6′ Jones & Lamson, R. & F. rest.
18″ x 6′ Perkins, R. & F. rest.
20″ x 10′ Bement Compound rest.
24″ x 12′ LeBlond Compound rest with chuck.
24″ x 14′ Lodge & Shipley Compound rest and taper.
24″ x 16′ Fifield Compound rest.
26″ x 22′ Pond Compound rest.
38″ x 16′ Fifield Compound rest with R. B. to swing 50″.
40″ x 21′ Fifield Compound R. with 4 chuck jaws.

Special Lathes

20″ x 12′ Schumacker & B. Screw Cutting, compound rest, with turret on shears having power feed.
24″ x 14′ Reed Special Turning Lathe, two tool posts, oil pan, pump, etc.

Hammers

25 lb. Bradley Helve.
200 lb. Bement-Niles Steam.
450 lb. Bell Steam, regular type.
900 lb. Trethewey Steam.
50 lb. Beecher & Peck Poppet Drop.
1000 lb. Merrill Board Lift.
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22″ x 20″ x 5′ J. S. Wheeler & Co.
30″ x 30″ x 8′ L. W. Pond M. T. Co.
42″ x 36″ x 11′ Wm. Sellers & Co.
72″ x 48″ x 20′ Betts Machine T. Co.

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No. 1 Cady Solid Back.
No. 2 Toledo Inclinable Open Back.
No. 3 Stiles Plain Solid Back.

Shapers

6″ Boynton & Plummer, Crank.
14″ John Steptoe & Co., Crank.
24″ Walcott Geared.
24″ Hondey Pillar type friction driven.
24″ Gould & E. Double Triple Quick with E. Base.

Milling Machines

Back Geared Lincoln type with vise and c. s.
No. 3. Garvin overhanging arm, vise and vertical fixture.
No. 14 Kempsmith Plain with back gear and power vertical feed.
No. 2 Lodge & Davis Plain with back gear and 12″ Index Centers.

Drills

10″ Dwight Slate Bench.
36″ Snyder S. H. B. G. Q. & P. H.
5′ Arm Niles Semi-Universal Radial (Niles.)

Keyseaters

No. 1 10″ Giant, capacity up to $1\frac{1}{2}$″.
No. 2 13″ Giant, capacity up to $1\frac{1}{2}$″.
No. 1 Davis, capacity up to 1″.

Pipe Machines

No. 1 Apex, capacity $\frac{1}{2}$″ to 2″, R. & L., dies and nipple attach.
No. 1 Apex, capacity $\frac{1}{2}$″ to 2″, R. H. dies.
No. 30 Curtis, $\frac{1}{4}$″ to 2″, R. L., Dies for hand power, side attach. mounted on stand.
No. $6\frac{1}{2}$ Merrell, capacity 1″ to 6″, hand and power.

Screw Machines

$\frac{3}{8}$″ Cleveland Automatic.
$\frac{5}{8}$″ Cleveland Automatic.
No. 3 Warner & Swasey, Plain Head, wire feed.
14″ Garvin Friction Geared Head, auto. chuck.

Brass Workers' Machinery

No. 1 American Tool & Machine Co., Fox Turret.
No. 2 American Tool & Machine Co., Cabinet Turret Lathe.
No. 1 American Tool & Machine Co., Square Arbor Fox Lathe with Chasing Bar.
2-Spindle Bardons & Oliver Valve Milling Machine.
Cock Grinder, Warner & Swasey, on column.
Cock Grinder, Warner & Swasey, on legs.
9″ Windsor Plain Head Turret Lathe.
16″ x 3″ W. & S. Plain Head Turret Lathe.

Speed Lathes

12″ Warner & Swasey, with slide rest.
15″ With set-over tail stock and two motions to spindle.
15″ Pryibil, with slide rest.
11″ x 5′ with pan, set-over tail stock, double cut-off, turret tool fitted to tail stock.
$9\frac{1}{2}$″ Brown & Sharpe Polishing and Finishing Lathe.

Cutting-off Machines

2″ Pratt & Whitney Single Tool.
4″ Hurlburt & Rogers, accelerated speed with two tools.

Punches and Shears

No. 6 Long & Allstatter Single End, 4″ throat, cap. $\frac{1}{2}$″ in $\frac{1}{2}$″ with Shear blades.
No. 1 Bremer Single End, 5″ throat, cap. $\frac{3}{8}$″ in $\frac{3}{8}$″.
No. 2 Bremer Single End, 6″ throat, cap. $\frac{1}{2}$″ in $\frac{1}{2}$″, extra blades for angle iron and four punches.
No. 2 Bremer Blacksmith 7″ throat, cap. punching $\frac{1}{2}$″ in $\frac{1}{2}$″; shearing flat $\frac{1}{2}$″ x 4″; round $1\frac{1}{8}$″.
No. 3 Bremer Single End, 7″ throat, cap. $\frac{5}{8}$″ in $\frac{5}{8}$″, with shear blades.
No. 3 Bremer Ditto, with 24″ throat.
No. 1 Bremer Single End, 10″ throat, cap. $\frac{3}{4}$″ in $\frac{3}{4}$″, with shear blades.
No. 5 Bremer Double End, cap. 1″ in 1″, with shear blades, 12″ throat.
No. 3 Bremer Blacksmith, cap. punching $\frac{3}{4}$″ in $\frac{3}{4}$″, shear, flat $\frac{3}{4}$″ x 4″; round $1\frac{1}{2}$″: $7\frac{1}{2}$″ throat.
Heavy Alligator Shear, 12″ blades.
No. 2 Buffalo Hand Power, cap. $\frac{1}{4}$″ in $\frac{1}{4}$″, $\frac{3}{4}$″ round, 7 16″ x 2″ flat.

Wet Tool Grinders

No. 1 Diamond Bench.
Double End, Leland & Faulconer, wheels 24 x $1\frac{1}{2}$.
Forming Tool Grinder, cup wheel 10 x $1\frac{1}{2}$, Foote, Burt & Co.
12 x $1\frac{1}{2}$, wheel on column with pump, Springfield Glue & Emery Wheel Co.
20″ x 3″, wheel on stand, Standard Machine Co Holyoke.
No. 2 Diamond on column, wheel 12 x $1\frac{1}{2}$.
24 x 2″ wheel, W F. & John Barnes.

Miscellaneous

36″ Swing Lathe for facing columns with parallel 6″ higher, with flange and test hole drills.
44″ Dorner & Dutton Car Wheel Borer, with 36″ chuck.
200 Ton Horizontal Hydraulic Press, capacity 72″ x 12′ centres.
9′ Wm. Sellers & Co., Boring and Turning Mill.
14″ Industrial Works Single Head Axle Lathe, 8′ 4″ centres.
9″ Bement Slotter.
14′ 6″ Wm. Sellers & Co., Plate Planer.
3″ Woodward & Rogers Centering Machine.
No. $3\frac{1}{2}$ Dayton Swaging Machine, $\frac{3}{4}$″ capacity for tubing.
No. 4 Adams Double Head Bolt Cutter with dies $\frac{3}{8}$″ to $1\frac{1}{4}$″, self-opening heads.
$\frac{1}{8}$″ Adt. Automatic Straightening and Cutting-Off Machine, 16″ and shorter with countershaft.
Rotary Slotting Machine up to $\frac{1}{4}$″, series H-Garvin.
No. 1 Horizontal Tapping Machine up to 3 16, Garvin.
5 Ton Crane 14′ Mast.
8 Ton Chain Hoist.
Pulley, Drilling and Tapping Machine.
No. 4 Flexible Shaft with stop clutch and clamp die.
No 1 Root Horizontal Rotary Blower.
No. 11 64″ Buffalo Double Belted Pressure Blower.
60″ Sturtevant Engine Driven Steel Plate Fan, outlet $22\frac{1}{2}$″, left hand up blast.
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25 H. P. Westinghouse, upright.
54 H P Fairbanks, also for gasoline.

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250 H. P. 24 x 10′ closed type.

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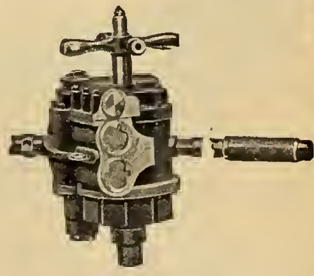

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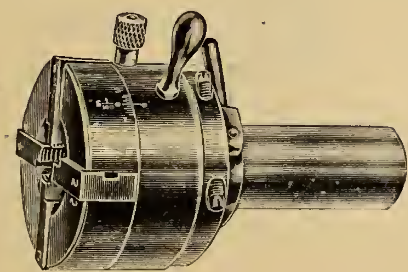

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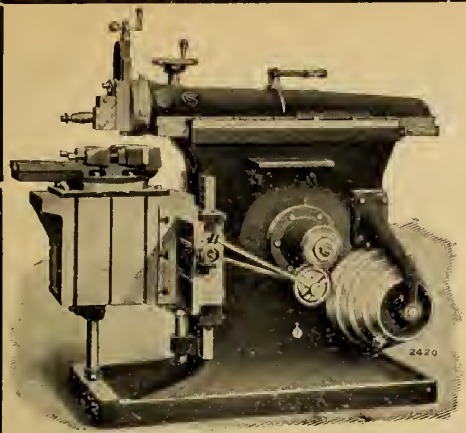

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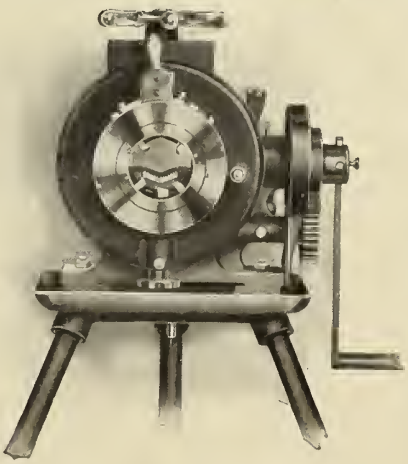

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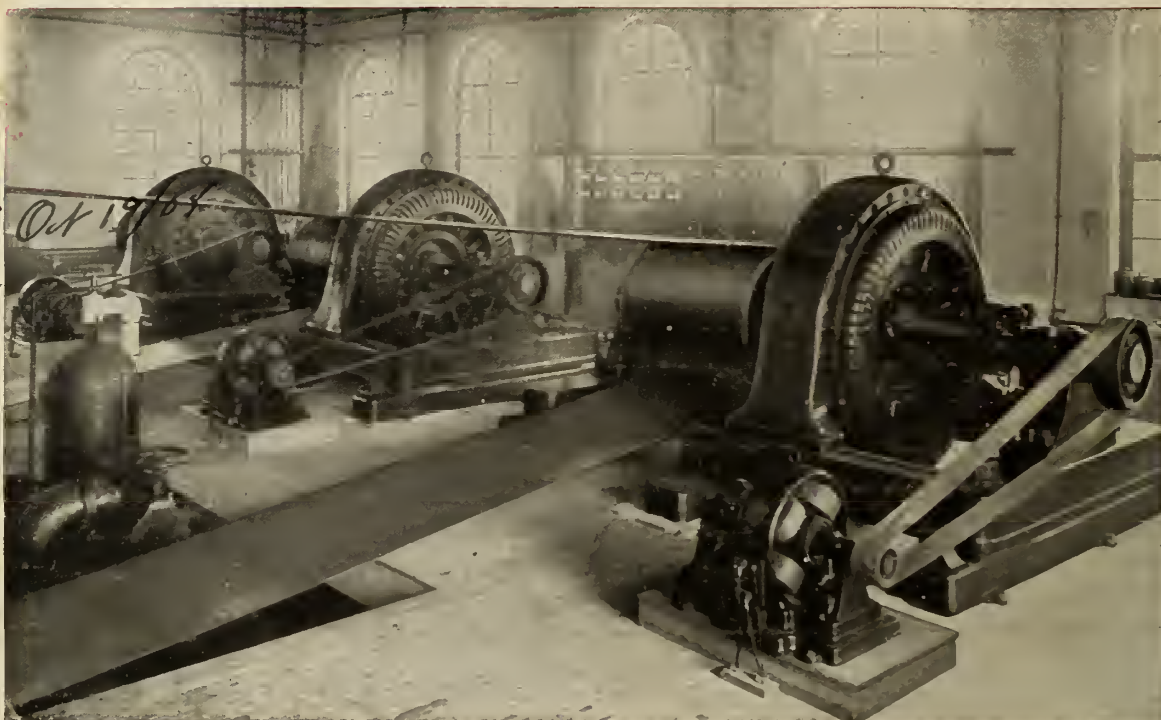

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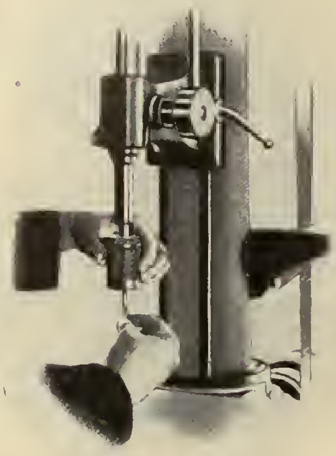

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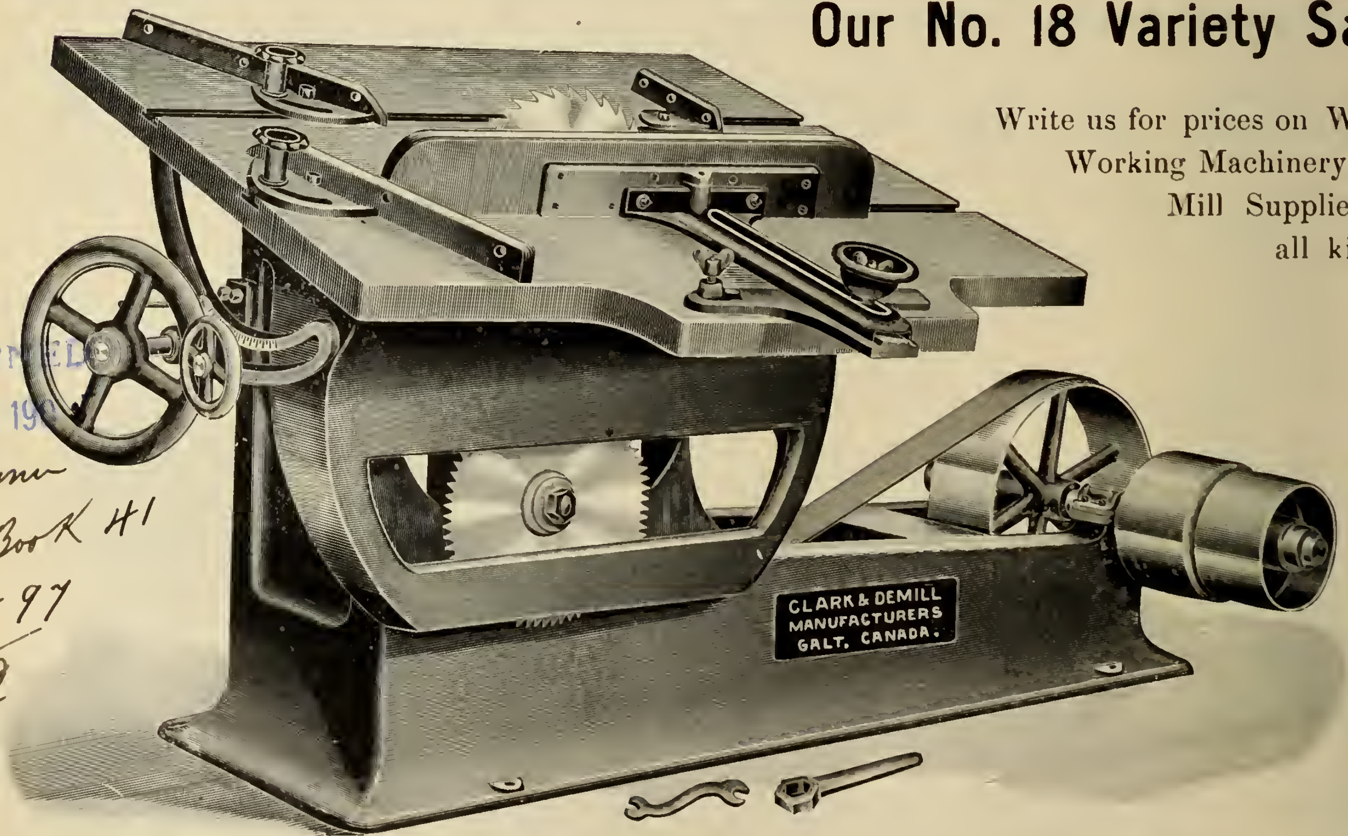

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48" x 13, 6" " 52 3" "
48" x 13' 6" " 42 3" "
44" x 13' 6" " 43 3" "
44" x 14' 6" " 40 3" "
44" x 11' 9" " 42 3" "
40" x 12' " 21 3" "
38" x 12' " 36 3" "
32" x 11' " 22 3" "

Upright Boilers

48" x 10' 6" with 152 2" tubes.
36" x 84" " 60 2½" "
36" x 72" " 60 2" "
30" x 72" " 42 2" "
26" x 60" " 37 2" "
26" x 48" " 31 2" "
24" x 50" " 31 2" "
20" x 40" " 41 2" "
2?" x 36" " 16 2" " NEW.
19" x 44" " 13 2" " NEW.
19" x 40" " 9 2" " NEW.

Automatic Engines

24" x 48" Stearns Corliss.
17" x 42" Right Hand Brown.
16" x 36" NEW Laurie Corliss.
13" x 30" Left Hand Wheelock.
11" x 24" " " Corliss.
12" x 10" Westinghouse Junor.
12" and 20" x 12" Erie Ball Tandem compound.
11" and 19" x 15" McIntosh & Seymour Tandem compound.
11" x 10" Peerless, self-oiling.
11" x 15" NEW No. 9 Jewel.
10" x 15" " " 8 "
10" x 12" No. 7 Jewel
8" x 10" " 5 "
8" and 13" x 18" Tandem compound.
6½" x 8" Armington & Sims.
5" x 7" " "

Other Steam Engines

12" x 12" Laurie, NEW, horizontal.
11" x 12" " " "
10" x 10" Leonard C. C. "
9" x 10" " " "
8¾" x 9" horizontal.
8" x 8" Laurie, NEW, horizontal.
7" x 12" horizontal.
7½" x 9" Dutton, NEW, horizontal.
7" x 7" NEW, upright.
6" x 9" horizontal.
6" x 7½" " centre crank.
6" x 8" upright.
6" x 6" " NEW.
5" x 6" horizontal.
5" x 7½" upright, centre crank.
Also several small engines down to ¾ h.p., horizontal and upright.

Marine Engines

8" and 16" x 12" NEW, fore and aft.
7" and 14" x 10" " " "
7½" and 14" x 12" steeple compound.
9" x 12" Doty,
9" x 12" NEW, complete.
7½" x 9" NEW, Dutton.
7½" x 8" " "
6" x 6" all complete.
5" x 7½" " "
Also several smaller ones.

Miscellaneous Engines and Boilers

48" x 9" Upright Sub. Tube Boiler.
30" x 84" " " " "
36 H. P. Horizontal Self-Cont. Boiler.
8 H. P. " " " "
25 H. P. Fire Box Boiler.
16 H. P. Waterous Portable Boiler.
7" x 10" Cornell " "
7½" x 11" Clyde Boiler.
48" x 72" Fitzgibbon Boiler.
4 H. P. Acme Engine and Boiler.

Gas or Gasoline Engines

One 50 H. P. New Ohio.
One 25 H. P. Toronto Junction.
One 21 H. P. New Ohio.
One 15 H. P. Pierce.
Two 14 H. P. New Ohio
One 14 H. P. Ohio on wheels.
One 12 H. P. Brantford.
Two 10 H. P. Haggas.
Three 8 H. P. Ohio, NEW.
One 7 H. P. Triton-Marine.
Two 6 H. P. Ohio.
One 6 H. P. Toronto Junction.
One 5 H. P. New Adams Marine
Four 4 H. P. New Ohio.
One 3½ H. P. Triton-Marine.
Two 3 H. P. Upright.
One 2½ H. P. New Brantford.
One 2½ H. P. Goldie & McCulloch.
Four 1½ H. P. NEW and Second Hand.

Pumps

1 12" x 7" x 12" Northy Duplex.
3 8" x 5" x 12" NEW Duplex.
5 6" x 4" x 7" " "
6 5¼" x 3½" x 6" " "
18 4½" x 2¾" x 4" " "
8 3" x 2" x 3" " "
8" x 5" x 12" Single Acting.
7" x 4" x 6" " "
6½" x 4½" x 7" " "
6" x 4" x 6" " "
5" x 3½" x 7" " "
Several Small " "
NEW Morris Centrifugal, Nos. 2 and 4.
NEW Taber Rotary. Nos. 0, 1 and 2.
3¾" x 8" pedestal plunger pump.
3" x 5" " " "
2" x 6" " " "
Several small plunger pumps.

Steam Appliances

NEW Pulsometers Nos. 4 to 7.
8 Steam Traps, all sizes.
150 h.p., Goldie, McC. Heater.
150 " NEW Laurie Heater.
50 " " " "
30 " " " "
40 " " Patterson "
30" x 96" Heater.
16" x 50" "
18" x 39" "

Engine Lathes

1 NEW 32" x 20' London.
1 " 32" x 18' "
1 30" x 14' Heavy bed.
1 NEW 28" x 18' London.
1 28" x 18' Dundas.
1 NEW 26" x 16', also 10' bed.
8 " 24" from 10' to 20 ft.
9 " 18" " 6' to 16 ft.
1 24" x 8' Dundas.
1 18" x 6' in good order.
6 NEW 16" from 6' to 10 ft.
2 16" x 6' rebuilt.
10 NEW 15" from 6' to 10 ft.
4 " 14" 6 and 8 ft.
3 " 13" 6 " 8 "
1 14" x 6' Dundas.
3 NEW 12" x 6 ft.
1 " 11" x 60" Barnes.
1 " 9" x 57" "

Cap and other Lathes

NEW 26" x 42" x 14' Gap.
" 24" x 40" x 12' "
" 30" x 46" x 12' "
" 18" x 32" x 12' "
12" x 24" x 60" Dundas.
22" x 8' Chucking Lathe.
18" x 8' Davis Turrett Lathe.
16" x 6' Fox Lathe.
NEW 15" x 6' Fox Lathe.
11" x 48' Speed Lathe.
NEW 11" x 72" Barnes Foot Power.
" 11" x 60" " " "
2 " 9" x 45" " " "
No. 4½ Barnes " "
9' x 40" Cincinnati " "

Iron Shapers

2 NEW 24" Back Geared Imperial.
2 " 20" " " "
1 " 16" " " Cincinnati.
1 " 16" Single Geared "
1 " 7" Rhodes.

Iron Planers

42" x 42" x 20' Putman.
NEW 36" x 48" x 12' London.
" 36" x 41½" x 10' London.
" 26" x 26" x 8' Imperial.
4 " 24" x 24" x 6½' Imperial
5 " 20" x 20" x 5' London.
24" x 24" x 36" American.
23" x 20" x 5½' American.
3 Small Hand Planers.

Drilling Machines

3 NEW 100' Plain Radials.
2 " 72" Universal Radials.
1 6 Spindle Multiple.
1 4 " "
2 NEW 31" Barnes.
1 " 28" "
1 " 24" Cincinnati, with tapping attachment.
1 NEW 24" London.
1 24" in good shape.
6 NEW 20" Barnes, B. G.
3 " 20" " Lever Feed.
2 " 14" Sensitive, Pedestal.
2 " 14" " Bench.
2 11" Plain, Upright.
1 NEW 12" Barnes Friction.
2 " 10" Friction.
1 " Fox High Speed Drill.
6 Sensitive Bench Drills, NEW.
2 Post or Wall Drills.
8 Blacksmiths' Hand Drills.
6 " " and Power Drills.

Presses and Hammers

1 No. 45 Power Press, NEW.
2 " 21 " " "
4 " 20 " " "
2 " 19 " " "
1 " 16 " " "
No. 2 Cady Press.
Heavy Bliss Stamping Press.
NEW No. 1, Challenge Soap Press.
Power Draw Press.
NEW Erie 400 lb. Steam Hammer.
" 150 lb. Drop Hammer.
2 " 150 lb. Law Power Hammers.
60 lb. Palmer Spring "
NEW 50 lb. Foot Power "
4¾" x 10" Steam Hammer.
Several smaller ones.

Punches and Shears

1 NEW 20" throat, London.
5 " 15" " "
14" throat, Bertram make.
NEW No. 5, Bremer, Single,
" " 4, " Double.
" " 2, " Single.
" " 1, " "
" " 1, " Double.
Large Power Alligator Shear.

Other Machine Tools

NEW No. 1, Cincinnati Plain Miller.
30" x 6" x 16', Stevens Un. "
6 NEW Power Hack Saws.
5 Iron Frame Keyseaters.
NEW 2" Cutting-off Machine.
" Centreing Machine.
Large Hand Screw Press.
2" Bolt Cutter and Threader.
NEW 1½" National Bolt Cutter.
" 1" Acme " "
" 2" " " "
4", Curtis Pipe Machine.
Several Bench and Pedestal Emery Grinders—all sizes.
2 NEW 2½ Ton Portable Cranes.
Crab Winches—all sizes.

Wood Planers

30" Heavy Smoothing Planer.
27" Cowan Double Surfacer.
26" Mc. G. G. " "
24" " "
NEW 24" x 9" Surface Planer.
24" Surface Planer, rebuilt.
24" Pony "
22" Surface " "
NEW 16" x 9" Surface Planer.
" 12" Pony Planer.
" 24" "Handy" Planer and Matcher.
24" rebuilt " " "
24" Douhle Surfacer and Matcher.
NEW 15" x 7" Lightning Planer and Matcher.
13" Fast-feed Flooring Machine.

Buzz Planers

3 NEW 12" Pedestal.
1 12" rebuilt.
1 10" "
1 6" "
58" Stroke Jointer.

Wood Moulders

8" 3 Side Cowan.
7" 3 " all rebuilt.
6" 3 " Cant, Gourlay.
6" Sash Sticker.

Saw Tables

NEW No. 18 Combination.
2 " " 1 Clement, Variety.
4 " Variety Tables.
Dimension Saw Table.
No. 3. S. F. Rip Saw, Ballantyne.
Egan Double Cut-off Saw.
NEW Champion Cut-off Saw.
Cowan Railway " "
4 Wood Frame Machines.
2 NEW Swing Saws.
2 Rebuilt " "

Band Saws

2 NEW 36" Pedestal.
36" Pedestal in good order.
NEW 32" Pedestal.
" 30" Bracket.
30" Bracket, rebuilt.
NEW 26" Pedestal.

Re-Saws

Rebuilt Band Re-Saw, 54".
40" Galt Circular Re-Saw.
36" " " "
Rogers Vertical "

Other Wood-Working Machines

2 NEW Heavy Shapers.
3 Rebuilt Shapers.
Galt Power Mortiser.
NEW Foot Power Mortiser.
Rebuilt " " "
4 Tenoning Machines.
2 Dowel Machines, 1½" and 2¼".
3 Dovetailing Machines.
36" Double Drum Egan Sander
3 Box-Nailing Machines.
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Waymouth Guage Lathe.
18" Wood Lathe.
Wood Trimmers, all sizes.
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Swing Shingle Machines.
Shingle Jointers and Packers.

Saw Mill Machinery

2 NEW 3 Block Mills.
3 Rebuilt Mills.
NEW No. 4 Tower Double Edger.
" Tower Trimmer.
No. 1 Gang Edger 3 16" Saws.
NEW Wood Frame Drag Saw.

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2?" " " Farrens.
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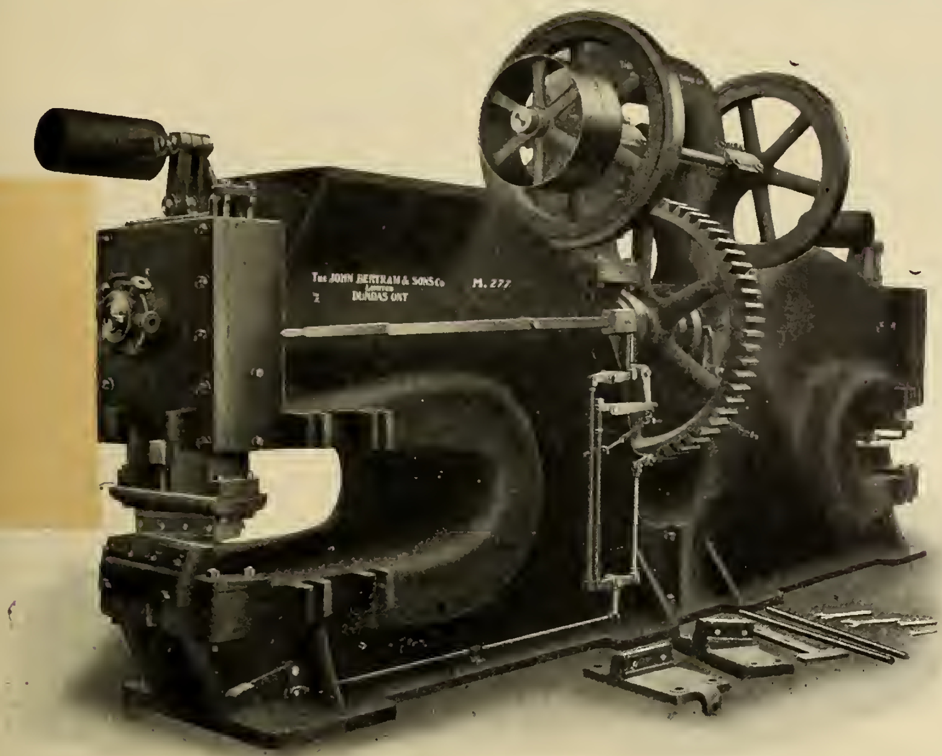

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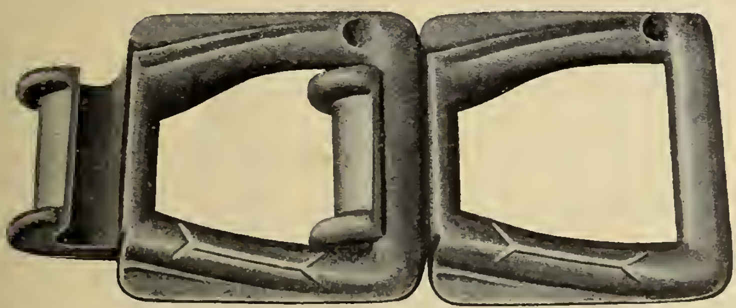

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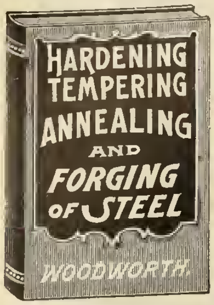

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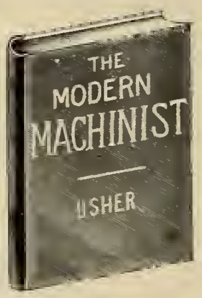

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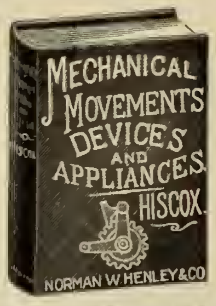

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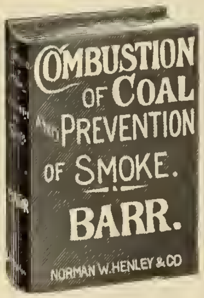

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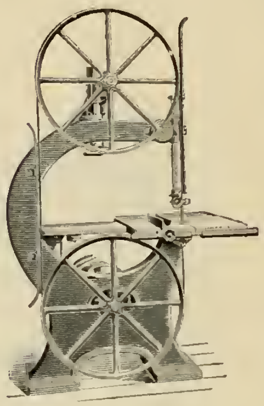

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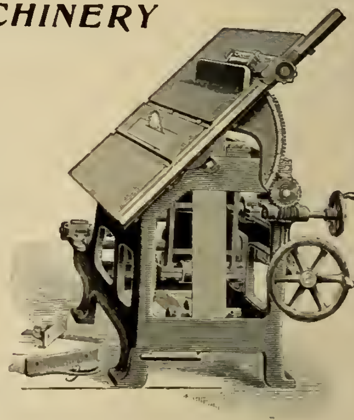

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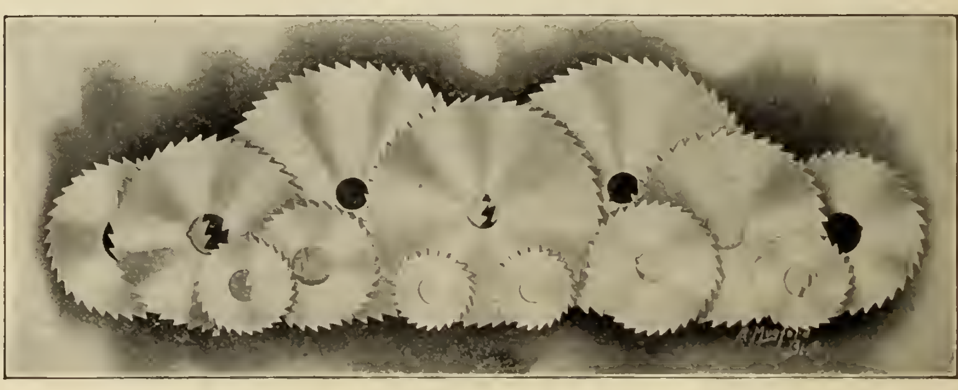

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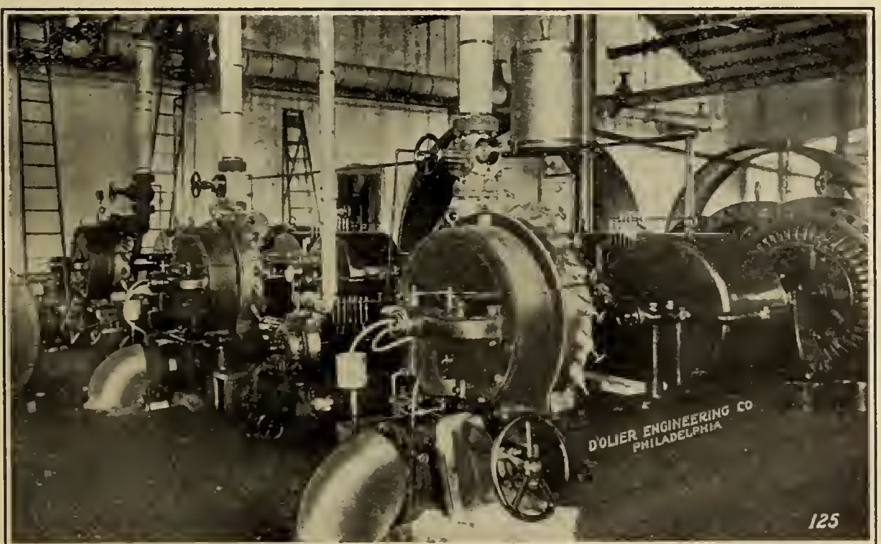

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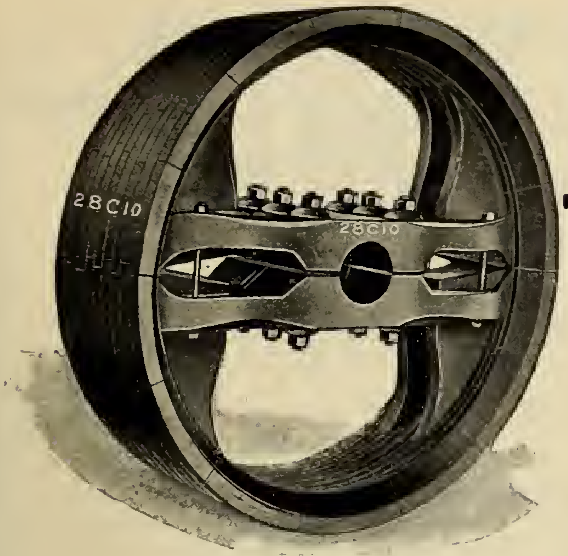

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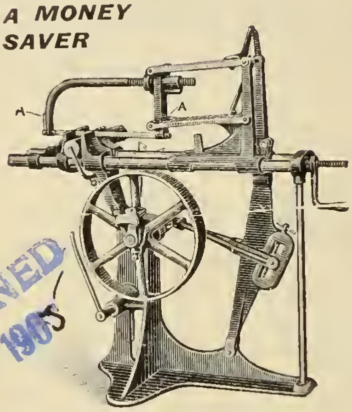

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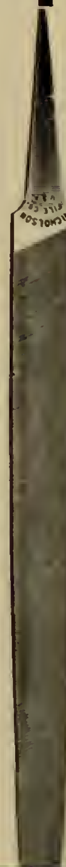

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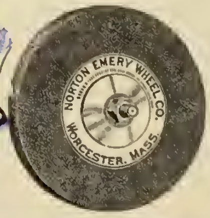


IF IT'S USED IN THE MACHINE SHOP WE'VE GOT IT.

THE CANADIAN FAIRBANKS CO., LIMITED

MONTREAL TORONTO WINNIPEG VANCOUVER

Modern Canadian Manufacturing Plants

ARTICLE VIII.—Model Plant of The Canadian Westinghouse Company, Limited, Hamilton, Ont.

It is universally recognized that the ideal manufacturing plant is one in which the best products are turned out at the least cost. There is not, however, such uniformity of opinion as to how this end, this ideal, is to be attained. Too often first cost so obscures other considerations that in the arrangement and equipment of the works important, though possibly not fully understood, details are neglected.

Anything that tends to cheapen production must be regarded as indispensable to an ideal manufacturing plant. To this end one must take into full account location, including cost of site and power, as well as shipping facilities and the labor supply; buildings, including, in addition to design and construction, the necessary facilities for possible expansion and the systematic and economic progress of raw material to finished article; equipment, which includes, besides the installation of the most efficient machinery, the arrangement of these in such manner as to reduce to the minimum the cost of production of each part and assembling of all in the finished article; labor, the desire being to secure the greatest working capacity at minimum cost; system, by which is meant the oversight of material to prevent loss or waste, and to discover the exact cost of each article produced.

It is abundantly manifested to one making a detailed study of the new works of the Canadian Westinghouse Co., Limited, at Hamilton, Ont., that all these essentials have been fully considered, with the result that the new works are a model of economy and effectiveness for the manufacture of electrical machinery.

This plant of the Canadian Westinghouse Co. is one of many illustrations of Canadian industrial expansion during the past few years. The name "Westinghouse" has now a world-wide reputation in the industrial field, built up by the inventive genius, business capacity and enthusiasm of the founder of the Westinghouse industries, Mr. George Westinghouse, assisted by the powerful group of practical mechanics and executive heads he has gathered around him.

Naturally an aggressive firm like the Westinghouse Co. soon learned of the magnitude and value of the Canadian market, with its unsurpassed supply of water power. So great have been the exports of the Westinghouse products to Canada that an examination into the conditions of a few years ago led to the decision to establish a separate company with manufacturing works in Canada, Hamilton being chosen because of its all-round advantages.

The Canadian organization is quite distinct from the American concern, considerable Canadian as well as Westinghouse capital being invested in the enterprise. The board of directors consists of the following: George Westinghouse, George C. Smith, L. A. Osborne, W. Y. Soper, C. F. Sise, H. H. Westinghouse, F. H. Taylor, Thos. Ahearn, P. J. Myler and Hon. J. M. Gibson. The officers are:

President—George Westinghouse.

1st Vice-President—H. H. Westinghouse.

2nd Vice-President—F. H. Taylor.

3rd Vice-President, General Manager, and Treasurer—Paul J. Myler.

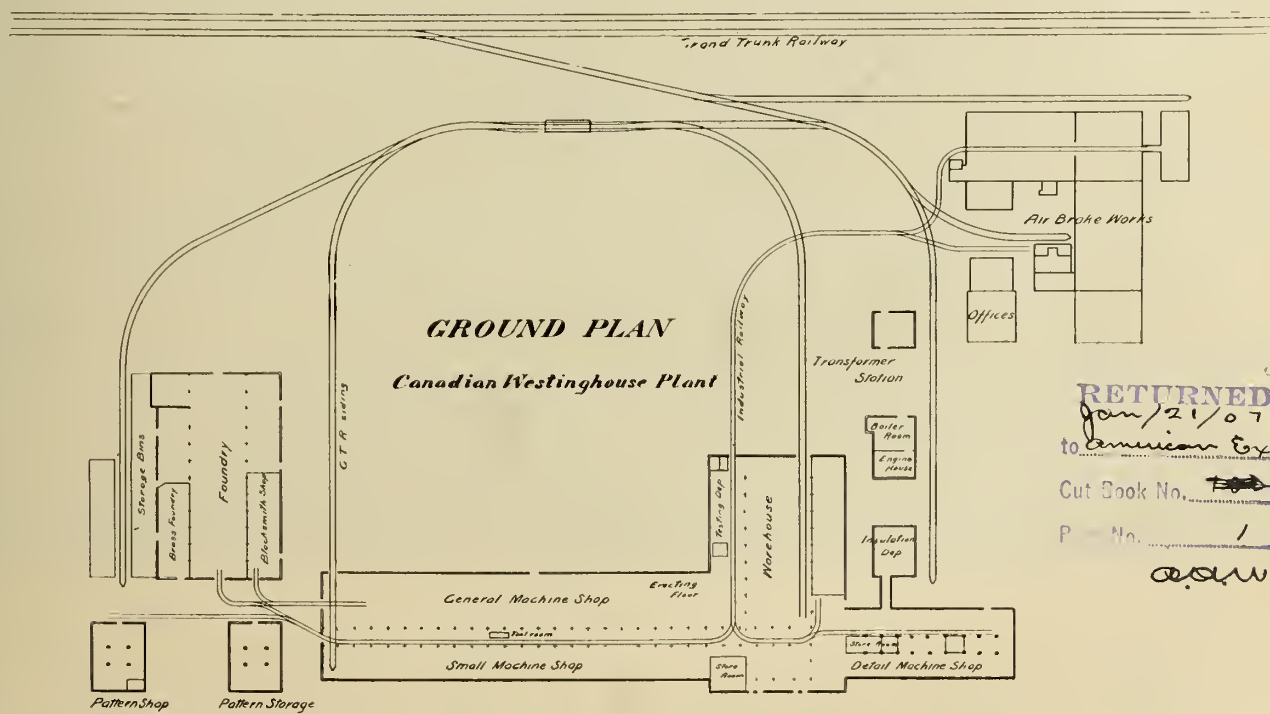
Secretary—John H. Kerr.

Sales Manager—N. S. Braden.

Manager of Works—F. A. Merrick.

Supt. of Air Brake Dept.—Percy Domville.

Besides the head office in Hamilton the company have sales offices in Toronto, Montreal, Halifax, Winnipeg and Vancouver. The air brake department, a manufacturing plant for which was started in Canada about ten years ago, has been consolidated with the electrical



department in the Canadian company, the old air brake works being left intact.

According to agreement all the inventions and designs of the Pittsburg company are at the disposal of the Canadian concern, which thus has every facility for keeping up-to-date in their manufactured product. These manufactures will be comprised of the following lines: Alternating and direct current generators and motors, including railway motors ; controllers, transformers, switches and switch-boards ; rheostats, measuring instruments, including meters ; arc lamps and various subsidiary lines.

The Plant.

In the layout of the yards and buildings and in the design of the buildings themselves, excellent provision has been made for the systematic handling of material and for extensions which may become necessary. This was facilitated to no small degree by the adoption of the electric drive system for the plant. The freedom from the necessity of grouping the buildings around a central power station with mechanical transmission in order to obtain economical drive gave a much wider scope in the design.

The warehouse, which may be considered the central building, runs north and south, the smaller machine shop wing projecting to the east end and the larger wing to the west. At the immediate end of the large machine shop are the foundry, the pattern shop and the pattern storage shop. To the east of the warehouse are the boiler-house, the insulation building and the sub-station. Somewhat detached and to the northeast are the office building and the air brake plant. Raw material is brought into the yards and the finished product shipped out on railway sidings. Throughout the yard and buildings material is handled by an industrial railway, 24-inch gauge ; also by traveling and jib cranes. The motive power on the industrial lines consists of storage battery locomotives, manufactured by the firm themselves. The buildings are concrete and brick, the foundation and walls to the window sills being constructed of concrete, the walls above of brick. All floors and roofs are of reinforced concrete as are also the columns. The roofs are nearly flat, a feature of them being the drainage, the leaders being brought down through the interior of the building to prevent freezing

Fire Protection.

In addition to the fireproof construction of the buildings an excellent fire protection system has been installed. In the annex to boiler house is located the fire pump of 1,500 gallons per minute capacity.

This is a standard Underwriters' Duplex Pump made by the Knowles Steam Pump Co. and to insure immediate availability of service steam is constantly kept up in the Stirling boiler plant adjoining, and an emergency supply of 150,000 gallons of water is continually kept in underground concrete lined reservoir near pump location.

The fire equipment throughout the building includes piping for sprinkler sprays, also numerous coils of hose connected to piping, each coil being marked by red incandescent light, constantly burning.

Heating and Ventilating.

The heating and ventilating system is complete, being designed on the plenum system, the air being drawn from the outside by large fans and discharged into the building by means of piping, the foul air finding egress through doors, windows and regular ventilating outlets. The system was installed by Sheldon & Sheldon, Galt, Ont. Steam used in the heating system is supplied from Stirling boiler plant above mentioned, being piped to convenient centres in each building where the necessary steam coils and fans are located. Besides this steam radiators are installed where deemed necessary.

For the Employes.

A creditable feature of the general plan is the splendid arrangement for the convenience of employes. Of this equipment the toilet rooms are the most noticeable. To save floor space these are situated on mezzanine floors in the different buildings—in the machine shop, between the large and small shops, and in the foundry above the core department. These are accessible by broad

General Machine Shop, Canadian Westinghouse Company.

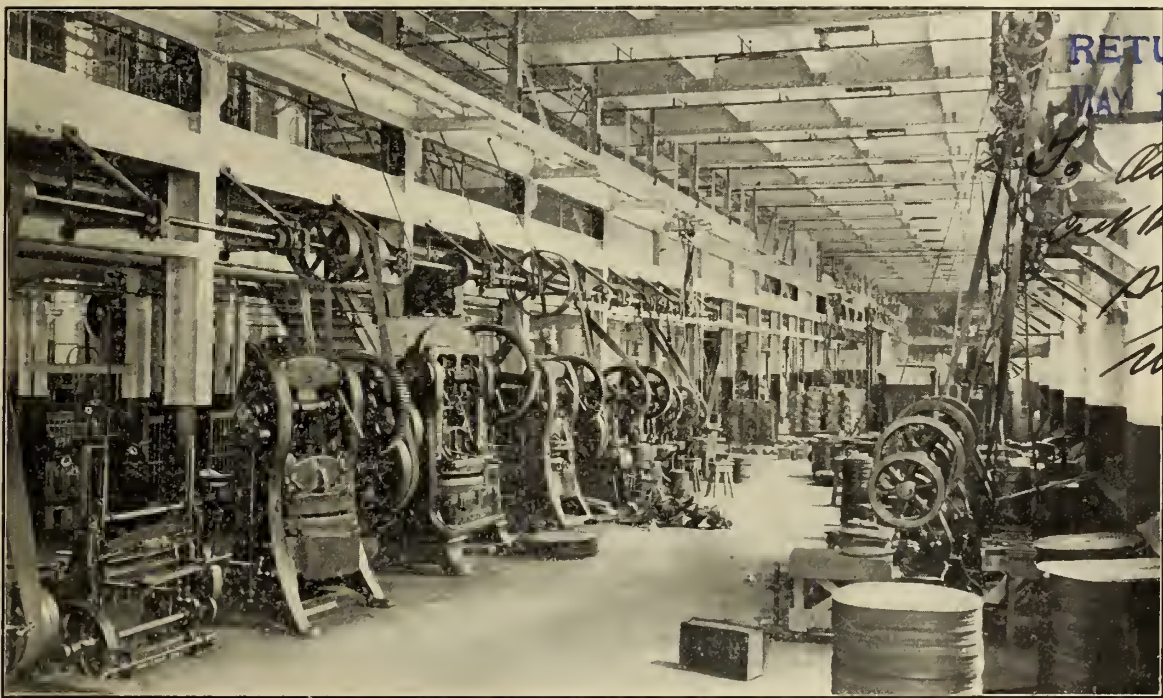
flights of stairs, steel concrete construction. The equipment throughout is of enamelled iron and hot and cold water is always to be had.

To distinguish the various piping systems in the plant according to their use, such as steam, water, pneumatic, gas, etc., each system is painted a distinctive color, thus lessening tendency to accident.

Electric Drive.

The tool equipment of these shops forms an excellent example of the principle of electric drive. All the tools in the larger machine shop are equipped with individual motors, while it has been found expedient to group drive the smaller machines throughout the other shops. The machines, with a few exceptions, in the punch department are group driven, as are also those in the shaft machine shop, the bearing and commutator machine shop, the rheostat and measuring instrument department, the winding department, the screwing machine department and in the tool room.

Wherever feasible an induction motor has been used, such as for group drives, and also for some of the machines and cranes. Practically all the individual driven tools, however, are equipped with D.C. variable speed motors, the three-wire system of distribution being used, voltages 220 and 110. Thus a speed variation of at least 4 to 1 can be obtained from the motor, and in special cases where greatly additional speed range is desired the supplemental gearing of the machine is made use of. This is probably the simplest and most efficient method of obtaining the speed variations necessary for the various tools in D.C. variable speed motor equipment. The controllers are the regular revolving drum type, placed wherever most convenient, on lathes the controller being operated from the apron. The motors are direct connected through gears, through the Morse silent chain, or, in a few cases, by belt. Lighting is supplied by alternating current at 110 volts. Arc, incandescent and Nernst lamps are placed throughout the works as the conditions demand — the general machine shop, for instance, being lighted by rows of enclosed arc lamps down each side, while incandescent and Nernst lamps are used in the detail machine shop departments.



Punch Department, Canadian Westinghouse Company.

Compressed Air.

Compressed air is used for various purposes throughout the works, but is used chiefly in the foundry and assembling floors for pneumatic tools. The compressor, made by the Canadian Rand Drill Co., is situated in the machine shop, and is operated by a 50-h.p. induction motor, and carries a pressure of about 80 pounds.

Gas and Crude Oil.

An interesting feature of the works is the gas and crude oil equipments for the annealing ovens and tempering furnaces in different parts of the works. The gas generating plant is situated in a small building between the machine shop and the foundry, the plant being installed by the American Gas Furnace Co. The gas is made from naptha, a large tank of which is stored underground. The crude oil equipment, installed by the Rockwell Engineering Co., consists of an underground tank together with a pump situated in the gas generator building, and the necessary piping to convey the oil to the desired points.

Pattern Shop and Pattern Storage.

In order to get a comprehensive idea of a manufacturing plant it is well to begin where the process of manufacture starts, and this is in the pattern-making building. The Westinghouse works pattern shop is a three-story building and basement, the latter having been built to accommodate the shafting for the machines on the first floor, which constitute a carpenter and cabinet shop, while pattern making proper is conducted on the second and third floors. The pattern storage building stands close to the pattern making building, and is exactly similar in construction, except that there is no basement. These two buildings gre equipped with electric elevators installed by the Otis-Fensom Elevator Co.

Foundry and Equipment.

The foundry building is of monitor roof construction with three bays. The middle bay constitutes the moulding department which is traversed by a 20-ton crane of the Northern Engineering Co., equipped with A. C. motors. The building is also traversed throughout its entire length by a traveling jib crane, $7\frac{1}{2}$ tons capacity. The cupola room is situated in the northern part of the west bay. The south end of the same bay serves as the brass foundry, an interest-

ing feature of which is the Rockwell melting furnace. Storage for sand, limestone, pig metal, etc., is provided in bins conveniently located along exterior walls of the building.

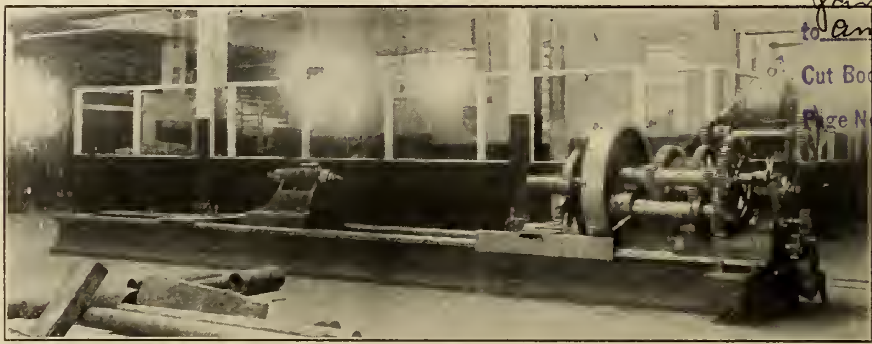
The pig iron from this storage is taken by industrial railway to an electrically driven elevator, which delivers it to the charging floor of the cupola. The coke is stored in a bin on the charging floor, being transported thence from the cars on the siding by an electrically driven conveyor.

A portion of the east bay is partitioned off to serve as the blacksmith shop, an important feature in the equipment of this shop being the down-draft forges which keep the room free from smoke. The exhaust fans used are driven by induction motors.

General Machine Shop.

From the foundry the castings go to the general and small machine shops, and it is logical to follow them through these shops until they arrive on the erecting floor. These two shops make up the long west machine shop wing, together with the tool room and the bearing and commutator machine shop which are on the floor above the small machine shop.

The general machine shop, a view of which is given, occupies the entire north bay of the wing. The small shop is divided into two departments, the punch department and the shafting department. As far as possible it is reserved for rotating parts, while the general shop is devoted to frames and stationary parts. A resume of the general machine shop equipment will give an idea of the different processes gone through by the parts on their way to the erecting floor. Among the machine tools the following may be found of special interest: A Newton Machine Tool Works cutting-off machine for bar iron, equipped with a 6-h.p., D. C. motor, driving through Morse chain; Bertram radial drills of 6 feet and 4 feet arm, all motor equipped, as shown in one of the accompanying illustrations, behind the multiple spindle drills; a two spindle, 5-foot radial drill press, specially built by the London Machine Tool Co. for drilling railway-motor gear cases; this is equipped with an A.C. constant speed motor driven by Morse chain, change of speed being obtained in the gear box; a Newton double-head milling machine. driven by 10-h.p. D.C. motor; Pond planers, one 3x3 feet equipped with 12-h.p. D.C. motor, another 5x5 feet equipped with 20-h.p. D. C. motor, also illustrated; vertical boring mills, of 34-inch swing, built by Colborne Machine Tool Co., with 5-h.p. D.C. motor; 44-inch Bullard mills with 10-h.p. D.C. motor; 84-inch Niles mills with 10-h.p. D.C. motor; 60-inch Bertram tools, with 9.8-h.p. D.C. motor; a 18-inch slab miller, built by the Ingersoll Milling Machine Co., equipped with 10-h.p. D.C. motor; a No. 3 Bement-Pond horizontal boring mill, the driving power being a D.C. motor, while another motor is used for raising and lowering the table.



Pittsburg Shafting Lathe, Canadian Westinghouse Company.

One of the most striking machines in the shop is an 8-spindle adjustable drill, also illustrated, made by the Baush Machine Tool Co., and equipped with 10-h.p. motor, Morse silent chain drive, and an accompanying item of interest is a special boring and milling machine combined, made by the Bement-Pond Machine Tool Co. This machine may be seen in the foreground of the view of the general machine shop. The boring bar or facing head has vertical motion, while the whole machine itself moves horizontally along its foundation by means of a rack and pinion. The tool is equipped with a 6-h.p. D.C. motor. Between this tool and the erecting floor is a portable milling machine, 5 h.p., D.C. motor drive, made by the Newton Machine Tool Co. It is used for milling dovetails in frames and stationary parts. Across the shop from this is a 260-ton Watson & Stillman hydraulic press for pressing laminations on revolving and stationary parts. Another illustration shows a Pittsburg Machine Tool lathe, which has a swing of 18 inches, and a bed 22 feet in length, this length being necessary for the turning of shaft for motor-generator sets or for belt-driven generators. It is equipped with a 15-h.p. D.C. motor, the controller being operated from the apron.

Tool Room, Bertram Planer in foreground, Canadian Westinghouse Company

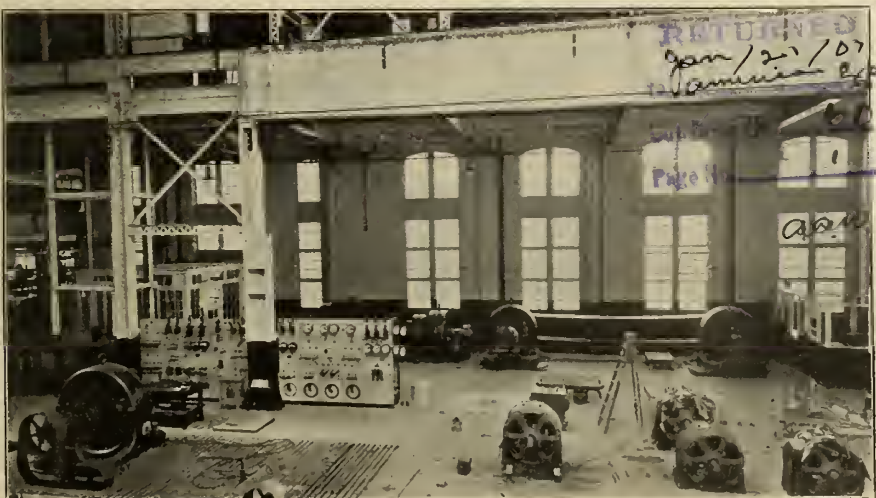
The general machine shop is equipped with two 20-ton electric cranes, supplied by the Morgan Engineering Co., operated by D.C. motors. One of these is high up and traverses the entire length of the shop, while the other runs on a

lower level and forms the connecting link with the warehouse crane.

Punch Department.

The punch department is at the west end of the small machine shop, which is traversed its entire length by a 5-ton, D.C. motor crane of the Northern Engineering Co. Communication is had with the erecting floor, and thus with the warehouse, by means of a jib crane. In the punch department, a view of which is given, all the laminated iron work is done. The laminated pieces are annealed in the ovens at the end of the department, pass through the painting department and on to the hydraulic press before spoken of. The equipment of this department consists of straight and other types of shears made by Brown-Boggs, Limited, Hamilton, and of a line of punch presses of different sizes, half of which were supplied by the Toledo Machine Tool Co. and the other half by the McGregor, Gourlay Co. The department for building up pole pieces is part of the punch department, and is equipped with Morton shaper, Prentice Bros. drills, and 100-ton vertical hydraulic press for pressing the pole pieces together, clamping and riveting. All the machines in this department are grouped and driven by a 20 h.p. induction motor. The shafting and hangers for all the group drives were supplied by Wood, Vallance Co., and all the pulleys are of pressed steel from the American Pulley Co. The belting used was supplied by Sadler & Haworth, the Beardmore Belting Co., and the Dominion Belting Co.

Shafting Machine Shop, Canadian Westinghouse Company.



Testing Department, Canadian Westinghouse Company.

Shafting Department.

An excellent view of the shafting department in the small machine shop is given, showing American and Bertram lathes in the foreground. The group of machines in this department are driven with a 20 h.p. induction motor, although several machines are direct driven by motor.

Other machines of interest are vertical boring mills driven by $7\frac{1}{2}$ h.p. D. C. motor, made by the Colborne Machine Tool Co.; 23-inch key-way cutter, the Morton Manufacturing Co.; milling machines, Becker, Brainard Milling Machine Co.; John Bertram 32-inch shafting lathe with taper-turning attachment, 10 h.p. D.C. motor; an Ingersoll Milling Machine Co.'s horizontal milling machine for milling key-ways; 32-inch Bertram shafting lathes, 7 h.p., D. C. motor drives, one having taper-turning attachment.

Bearing, Commutator and Brush Holder Department.

This department is situated on the floor directly above the shafting department and the equipment includes 100-ton Boomer & Boscher hydraulic presses, several small Prentice drills, a 42-inch Bullard vertical boring mill, 7 h.p., D. C. motor; a 30-inch Colborne vertical boring mill; several 20-inch McGregor-Gourlay lathes, taper-turning attachment; No. 3 Cincinnati plain milling machines; vertical tapping machine, Garvin Machine Tool Co.; a number of Becker-Brainard vertical milling machines; a pair of Bement-Niles 6-inch slotting machines; a line of Prentice sensitive drills, etc.

For this group of tools two lines of shafting are operated by 30 and 15 h.p. induction motors respectively. The product is taken to the erecting floor below by elevator furnished by the Otis-Fensom Co.

Screwing Machine Department.

This department is situated on the upper gallery between the warehouse and the machine shop, together with a stock room. The equipment includes: Bertram and London Machine Tool pipe and bolt threading machines; Brown & Sharpe hand screwing machines; Brown & Sharpe automatic screwing machines; and Pratt & Whitney turret lathes. The line of shafting is operated by an induction motor.

The Warehouse.

The warehouse has a high bay in the middle, a gallery on the west side and two on the east side. The high bay is traversed by a 20-ton Morgan Engineering Co. crane, D.C. motor drive. This bay forms the testing and shipping departments into which runs a railway siding, by which stores are brought in and goods shipped out. In the same manner that raw materials are delivered at the foundry and progress through various stages toward the erecting floor,

the necessary minor raw materials are delivered at the warehouse storage room whence they go to the various departments, passing from there to the erecting floor.

The detail machine shop wing has three floors, equipped with the machines necessary in the making of the smaller products. A view of the detail machine shop on the second floor is given which is typical of machine equipment for this class of work.

The insulation treatment is carried on in a separate building. The switchboard department is situated on the first gallery on the east side of the warehouse, and here the boards are completely erected before shipment.

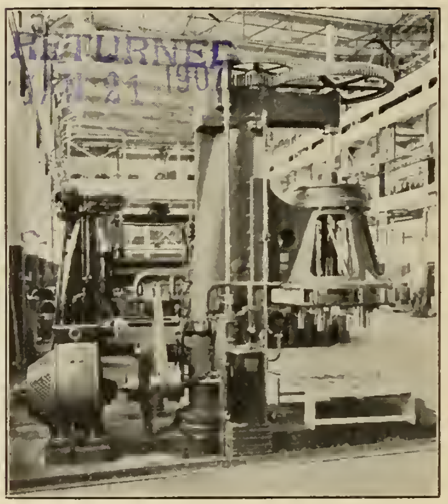
Testing Department.

The erecting floor is the centre to which parts of machines come from the general machine shop, from the small machine shop, from the bearing and commutator department, from the detail machine shops, from the winding and insulation departments and, if necessary, from the warehouse, and there the machine is erected. It is then transferred by the lower machine shop crane to the warehouse crane, which conveys it to the testing floor, and after testing it is passed across to the shipping floor where it is painted and otherwise finished, crated and either sorted or placed on cars for shipment.

An excellent view of the testing department is given herewith. From it a good idea of the equipment can be obtained. In addition to the testing operations from this switchboard are controlled all the power and lighting circuits throughout the building. Beyond the board can be seen several machines, including the motor-generator set supplying the direct current for the D. C. variable speed motors.

The Tool Room.

Having followed the raw material through the several departments until the completed machine leaves the works by the railway siding, it is now interesting to examine the tool room and its equipment, from where are supplied all the tools and dies used throughout the works. A view of this room is given. In the equipment might be mentioned a number of Becker-Brainard milling machines; several Cincinnati milling machines, plain and universal; several Prentice drills, and also a line of two, three and four spindle drill presses; a



Multiple Spindle and Bertram Drills.

number of Potter & Johnston shapers; several universal oscillating grinders for grinding the faces of dies, etc., made by the Springfield Manufacturing Co.; Bullard and Colborne vertical boring mills; Bertram D.C., motor driven planers, seen in the foreground of the illustration; a 24-inch Bertram slotting machine; a number of 4-feet radial drills, made by the Bickford Drill & Tool Co.; a number of grinding machines supplied by O. S. Walker & Co., and the Cincinnati Milling Machine Co., the Walker grinders being supplied with magnetic clutches; three Brown & Sharpe inside and outside grinders; and a line of lathes, product of the American Machine Tool Co., R. McDougall and Pratt & Whitney. There are two lines of shafting run by 30 h.p. induction motor and a 15 h.p. induction motor respectively.

General Offices.

A description of the plant is not complete without a word of reference to the general offices. The furnishing and equipment of these offices is of the same high standard as that already described for the works and the same thorough system is evidenced throughout.

In the plant of the Canadian Westinghouse Co. are exemplified the most modern ideas of industrial construction and operation, and the works are certainly a valuable addition to Canada's industries.

HORSE SENSE.

If you work for a man, in Heaven's name work for him.

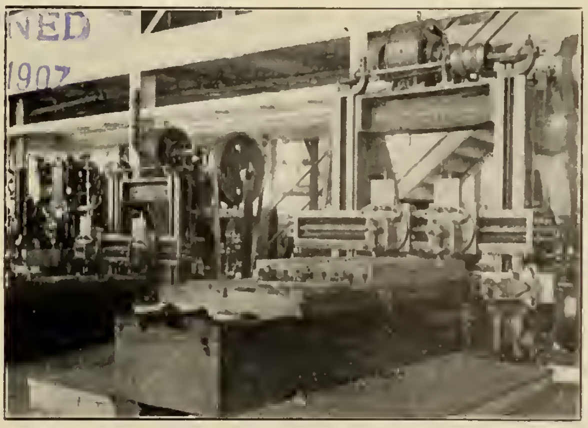
If he pays you wages that supply you your bread and butter, work for him, speak well of him, think well of him, stand by him, and stand by the institution he represents.

I think if I worked for a man I WOULD not work for him a part of HIS time, but ALL OF HIS TIME. I would give an UNDIVIDED SERVICE OR NONE.

If put to a pinch, an ounce of loyalty is worth a pound of cleverness.

If you must vilify, condemn, and eternally disparage, why, resign your position; and when you are outside, DAMN to your heart's content. But, I pray you, so long as you are a part of an institution, do not condemn it. Not that you will injure the institution—not that—but when you disparage the concern of which you are a part, you disparage yourself

And don't forget—"I forgot!" won't do in business.—ELBERT HUBBARD.



Niles Planers.

Detail Machine Shop.

Mr. Willis Chipman, C.E., of Toronto, has been engaged to design water works and electric light systems for the corporation of Dalhousie, N.B.

Mr. W. C. Thomas has been appointed smelter superintendent of the Dominion Copper Co.'s works at Boundary Falls, B.C.

*Practical Mechanics**

By W. H. Raeburn

THESE short articles are undertaken for the purpose of presenting some of the fundamental principles that underlie the construction of machinery in such a way that those readers who have not been able for one reason or another to grapple with a subject usually presented in a setting of mathematical formulae, may derive a little information, both interesting and profitable. The study of elementary algebra is of great benefit to the mechanic who desires to know the how and why of things, but the fact remains that many a good mechanic has a desire to know a little about some of those matters that are generally made incomprehensible to him on account of the free use of algebra formulae which discourage instead of help.

In the question and answer columns of this and other technical papers we find questions such as these asked: How is the power required to do a certain amount of work calculated? What is understood by starting torque? Or how are the gears for screw cutting in a lathe figured out? Such matters as these questions relate to will be dealt with from month to month.

Force and Work.

Let us begin by considering what is understood by the term force as applied in mechanical work. Force is that which produces, destroys or tends to produce or destroy motive.

The pressure of a machine or building upon the underlying foundation caused by the attraction of the earth, the effort of the particles or molecules of steam to separate from each other, thus producing pressure on the inner surface of the boiler, pipe, or cylinder containing the steam, the pull of a belt derived primarily from the forces of expanding steam, falling water or electric current, these are examples of what is understood when we speak of a force. We measure forces generally by pounds, sometimes by tons exerted per square inch or square foot. The steam gauge attached to a boiler stands at 80 pounds, which means that there is a pressure of that amount on every square inch of the inner surface of the boiler. To be accurate we should say that there is 80 pounds per square inch more pressure inside the boiler than outside for the weight of the atmosphere produces a pressure of about 14.7 pounds per square inch. It matters not how great the force exerted is if motion be not produced there is no work done. This point is worth remembering.

Let a man weighing 150 pounds ascend a ladder a distance of 20 feet, carrying a load of 50 pounds, he raises a weight of 200 pounds through a vertical distance of 20 feet, $200 \times 20 = 4,000$, so we say he has done 4,000 foot pounds of work. A hand-wheel on a machine is used for traversing a heavy slide, the diameter of the wheel where the handle is attached being 14 inches. The operator can easily exert a force of 15 pounds on the handle as he revolves the wheel. During one revolution his hand moves $14 \times 3\frac{1}{7} = 44$ ins., so that he does $15 \times 44 = 660$ inch pounds of work, or if we wish to express it thus $\frac{660}{12} = 55$ foot pounds of work.

Now if this hand-wheel were to be used to raise a block on a vertical slide and the connection between the hand-wheel and block was such that half the work or power applied at the hand-wheel was lost overcoming friction in the mechanism, we can easily calculate how far a man can raise a block if its weight and the speed of the hand-wheel are given. Let the weight be 600 pounds and the wheel make 50 revolutions per minute.

The work done at the hand-wheel in one minute is $660 \times 50 = 33,000$ inch pounds. Only half of this or 16,500 inch pounds is available as explained, so that 600 multiplied by the height required will equal 16,500 inch pounds; we find that height thus $\frac{16,500}{600} = 27\frac{1}{2}$ ins.

We shall consider later on the laws governing losses from friction.

Horse Power.

Many have learned the rule for calculating the horse power of a steam engine, but have never really understood the underlying principle involved, so that there cannot be the same confidence as when that is understood.

We shall in the meantime take a simple example in calculation of horse power. What horse power will a 4 inch double belt transmit, running on a 12-inch pulley at 200 revolutions per minute? A 12-inch pulley has a circumference of $12 \times 3.1416 = 37.7$ inches, or 3.1416 feet, so that a point on the rim, or what is the same thing, any point on the belt, moves through 200×3.1416 628.32 feet in one minute. Let the turning force applied to the pulley, or, perhaps it would be better to say the resistance to motion of the driven pulley be such as to cause a pull in the belt of 200 pounds. This would be the difference between the tensions on the tight side and slack side of the belt, the former being probably 400 pounds and the latter 200 pounds. The proportion between the tensions on the tight and slack sides depends on the friction between the belt and pulleys and on what is termed the arc of contact of the belt, this signifying the part of the circumference of the pulley which the belt covers. Assuming then, a working pull of 200 pounds, which would be 50 pounds per inch width of double belt—a fair load—we have this force exerted through a distance of 628 feet in one minute, or $200 \times 628 = 125,600$ foot pounds of work are done. To convert this into horse power we divide it by 33,000 $\frac{125600}{33,000} = 3.8$ horse power.

A horse power is the amount of work represented by 33,000 foot pounds performed in one minute. Any combination of force and distance which when multiplied together equal 33,000, is one horse power, but it must be carefully noted that the work has to be performed in one minute.

A resistance of 200 pounds overcome through a distance of 165 feet in one minute makes one horse power. The steam engine problem is not at all difficult, but we must know the average steam pressure exerted on the piston. In the absence of means for accurately ascertaining this a usual method is to assume half the pressure indicated by the gauge at the boiler.

We shall find the H.P. of an engine with cylinder 12 inches in diameter, 24 inch stroke of piston, running 150 revolutions per minute, with an average steam pressure of 40 pounds per square inch. We first find the total pressure on the piston and then the distance through which the piston moves in one

*[The first of a series of valuable articles on the subject of Practical Mechanics. These will be educative in the highest sense, and should not only be read but studied by all ambitious mechanics.—Ed.]

minute. These two multiplied together give foot pounds, which, divided by 33,000, give H.P.

The area of a 12-inch circle is $12 \times 12 \times .7854 = 131$ square inches; $131 \times 40 = 4,520$ pounds pressure on piston which moves through 2 feet $\times 2 \times 150 = 600$ feet in 1 minute. We have now force and distance so that $4,520 \times 600 = 2,712,000$ foot pounds and $\frac{2,712,000}{33,000} = 82.18$ horse power, the result desired. The decimal figures can fairly be omitted from such results as these, as we have not the accurate information necessary to insure close results.

In presenting this subject to elementary classes the writer has put this question: How much work is done in sliding a block weighing 1,000 pounds on a horizontal surface through a distance of 2 feet? An unwary student would promptly reply 2,000 foot pounds, an entirely wrong answer. The resistance overcome is not 1,000 pounds, but only the friction caused by that weight, which depends entirely upon the nature of the surfaces. To raise 1,000 pounds vertically through 2 feet requires 2,000 foot pounds of work, but to slide the same piece 2 feet horizontally might not require any more than 160 foot pounds. In the next article we shall consider friction as it affects our work in machine construction.

A PECULIAR PROPOSITION

Having occasion to re-bore an eight horse-power gas engine cylinder, and owing to its being solid with the bed, and entirely too large for any of our machines, we contrived the rather unique way as shown in sketch of boring the same, which proved a very good method, was economical, accurate, and saved considerable time and expense. We had a long, true boring bar, and on it put three had our cutter; then on the other end the hardwood collar, No. 3, was fitted a tight fit to act as a guide or steadier to keep bar in perfect alignment. On getting a cut started we found the bar had a tendency to feed ahead itself, so we threaded a long rod and put on a check nut, and slacked off same steadily, and with a crank on the end of our boring bar, as shown, of a good length, we accomplished what seemed like an impos-

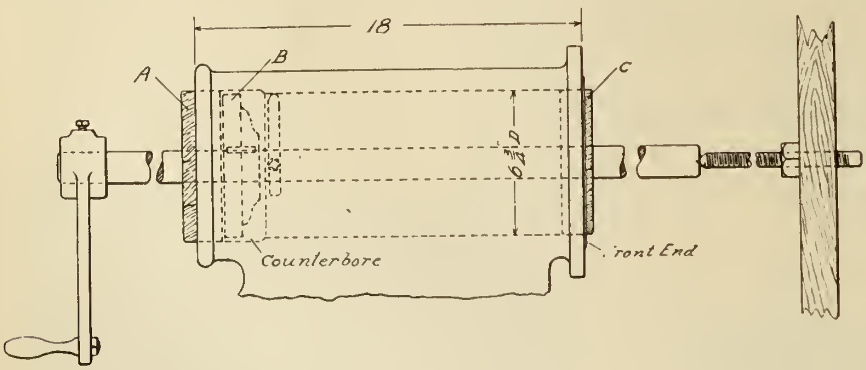


Diagram Showing Method of Operation.

hardwood collars, as shown in sketch. First of all, I must explain conditions under which we worked. The front end of the cylinder we found on examination to be true, the piston not traveling to within an inch and a half of the end of cylinder. The back end, of course, was not worn on account of the counterbore. With these two points to work from we were sure to come out true, so making a hardwood collar (maple) No. 1, to fit boring bar on the inside, and a tight fit in the counterbore outside, then close to that we put another collar, No. 2, to fit bar as before, only this was turned to the size the cylinder was to be re-bored to, and as close to this as possible we

sible proposition for us to handle in about one hour, and saved ourselves a hard job by using our brains. The cylinder had never been unfastened from the bed proper for fifteen or twenty years, and there being such a height on the sub-bed, which formed part of the cylinder, which height, by the way, has to clear a 68 inch fly wheel, would have necessitated a large machine and been a difficult job to true up. Some of the principles of our experience may be, I trust, useful to your thousands of readers on a job of similar nature.

EDWIN KRUG,

of Krug & Crosby, machinists and engineers, Hamilton.

MACHINE TOOL EXPANSION.

Three Canadian machine tool firms have shown great energy and enterprise within the past month in taking steps to increase their output very considerably. These are John Bertram & Sons Co., Limited, Dundas, the London Machine Tool Co., London, and the Jenckes Machine Tool Co., Sherbrooke. At the Bertram works a new foundry is now under way which will be one of the largest in the country, to be equipped with all the modern devices known, and will facilitate increasing very materially the already large output of this growing concern.

The London Machine Tool Co. have already given contracts for the construction of a new plant at Hamilton. They have bought eight acres of ground and are erecting at present a machine shop 250 feet long, 110 feet wide, a portion of which is saw-tooth construction. This building is to be ultimately extended to 400 feet long. The main erecting aisle is to be 50 feet from centre to centre of crane run-ways and controlled by a 25-ton Niles crane, having a maximum lift of 38 feet. Small cranes and jib cranes will be provided for various portions of the building. The heating will be a force blast system and the power used will be electric. The moulding shop which will be at right angles to the machine shop will be 150 feet long, 110 feet wide, controlled by two 25-ton cranes. The moulding shop will be ultimately 350 feet long. The pattern storage will be 40 feet wide, 150 feet long, of fireproof construction. In laying out the works great care has been taken to insure a minimum amount of handling of material. Tracks will run into moulding shop and into machine shop. The contract for the steel work has been let to the Locomotive & Machine Co. of Montreal and for the masonry and carpentering to George F. Webb, contractor, Hamilton. It is expected that the buildings will be ready for occupation the first of January.

After due consideration as to whether they should extend their plant at Sherbrooke or build a new one it was decided by the Jenckes Machine Tool Co. to erect a new plant at St. Catharines, Ont., this place offering various advantages, important amongst which was lower freight rates. The new works are in course of erection and it is expected to have them in operation by the end of the year.

Mr. H. F. Stratton, who has been connected with the principal office of the Electrical Controller & Supply Co., at Cleveland, Ohio, has accepted the posinected with the principal office of the same company, with offices at No. 136 Liberty street, New York City.

Electrical Review of the Month

OPINIONS AND STUDIES WORTH NOTING

STEAM VERSUS ELECTRICITY.

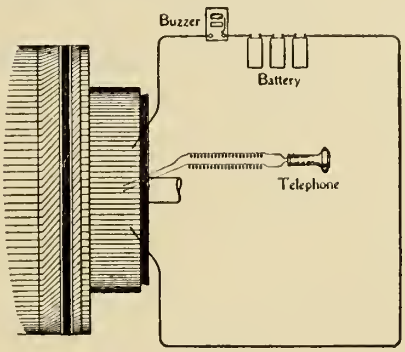
IT is the customary American practice to install steam auxiliaries in large generating steam stations. That is to say, the power required to drive the pumps and fans of the plant is not supplied by motors receiving current from the bus-bars, but by small independent steam engines receiving steam from the main boilers. The reasons ordinarily assigned for this preference are mainly in regard to security and convenience. It is urged that any failure of current at the bus-bars does not involve the stoppage of the station auxiliaries when the latter are driven by independent steam engines. Moreover, if steam is needed for heating the buildings or for other purposes, this steam has to be taken from the boiler main-steam pipes if all the auxiliaries are motor-driven; whereas it may readily be supplied from the exhaust of the auxiliaries, if these are steam-driven. In Europe, on the other hand, the practice varies in this respect. In the most modern central station steam plants there are some which employ all the steam for driving turbines connected to high-tension alternators, and the auxiliaries are driven by direct-current motors, which are supplied from the bus-bars, through step-down transformers and converters, in connection with a storage battery. The storage battery enables the auxiliaries to be driven for several hours independently of the pressure at the high-tension bus-bars.

As regards economy in fuel, it might seem at first sight as though the advantage might lie in favor of the electric drive, since the steam consumption of the auxiliary engines is wasted by comparison with that of the large turbo-alternators. It is doubtful, however, whether fuel economy can always be secured by the electric drive. The current for the motors has to be supplied after electric losses have been incurred in storage-battery, converter, transformer, and dynamo. The advocates of the electric drive usually admit that there is no claim to be made on their practice for fuel economy. They claim that the electric drive is the simpler aad more reliable. They point out that they substitute copper wires for steam-pipes, and that they are able to reduce the steam-piping of the station to its simplest elements. There is no doubt much to be said on each side of the question, and the selection is likely to depend upon local custom and local conditions rather than on strictly impartial considerations. Almost everyone will admit, however, that the ideal central steam station is one which employs its boilers solely for delivering high-pressure steam to its main engines, and where the auxiliary engines are as few, as subordinate, and as simple as possible.—Electrical World and Engineer.

A SHORT CIRCUIT DEVICE.

IT is often necessary to test a closed winding without disconnecting the winding from the commutator. A convenient device for this work consists of three dry battery cells, a buzzer for interrupting the current and a telephone receiver.

A short circuit can readily be located



A Short Circuit Device.

by passing the interrupted current from this apparatus through the winding, as indicated by the sketch, and then moving the leads from the receiver from bar to bar on the commutator. If there is a short circuit between the bars of the commutator or winding, there will be no audible vibration in the receiver. If, on the other hand, the winding and commutator are clear of short circuit at the point tested it will be indicated by a distinct vibration or buzzing.

In the case where an alternating circuit of 200 or 100 volts is at hand a more convenient method of finding a short circuit is to attach the leads of this circuit to almost any part of the commutator of the armature to be tested. Then the same method as before can be followed with the result that the vibration is much more distinct than in the former case, and the ceasing of these vibrations can be easily marked. In the first experiment a current of a few amperes in series with a small resistance was used, but this may vary slightly provided that enough resistance is put in to prevent burning the winding.

The vibration is much more distinct in the case of the large armatures than in the smaller ones, probably due to the difference in the transformer effect of the various sizes of armatures.

The same experiment was tried with a magneto box instead of the shop circuit. In this case no sound whatever could be obtained either in the winding or the commutator.—Electrical Journal.

RESUSCITATION FROM SHOCK.

DRS. CRILE and McLeod conclude that death from the passage of a heavy current through the body is due to either temporary stoppage of the heart or "inhibition," as it is termed by medical men, or to immediate action on the heart, causing what is called fibrillary contraction of the ventricles, or, in other words, contractions of the muscular fibres of the heart, whose function it is to force blood to the general circulating system and lungs. There is also a fall of the arterial blood pressure. The blood pressure is the tension exerted by the blood upon the walls of the vessels under the influence of the heart's action, and may be likened to water pressure in a pipe line. Dr. Crile has made very extensive researches into the question of blood pressure in surgery, and has found that blood pressure may be raised by the use of a saline solution containing a certain proportion of adrenalin, which is a drug obtained from what is known as the supra-renal gland, generally of the sheep. In the course of the experiments previously referred to, several points were brought out which are interesting when considered in connection with practical work on high tension lines. It was shown that an important factor in a fatal electric shock is the action of the current upon the heart itself, and that unless a relatively large part of the current passing through the body traverses the heart, the shock will not necessarily prove fatal. It was further shown by the results of the experiments that it is the amount of the current passing through the body rather than the voltage to which death is due. It was also demonstrated that by the prompt appli-

cation of artificial respiration, respiration could in some cases be re-established. Especial examination of the blood showed that electric currents up to 2,300 volts caused no chemical or other changes in the blood itself, and animals whose blood was subjected to this test, and which were allowed to live, showed no later effects. Neither does the current cause any change in the tissue of the brain, spinal cord or other nerve structures, as the animals subjected to this voltage and allowed to live showed no depreciation in function. For, example, current at a pressure of 2,300 volts was passed through the brain of a dog, laterally and vertically, over a period of one minute. The dog was then resuscitated from the immediate inhibition or temporary suspension of animation and allowed to live. No after effects were noticed.

The following method of resuscitation is suggested by Dr. Crile: "Place the patient at once upon his back with the head turned on one side; place one hand upon each side of the chest over the heart, then exert rhythmic or regular pressure at the rate of approximately 40 to 60 times per minute, so as to press air out from the lungs and cause the heart to empty itself; with each pressure upon the movable ribs air is forced out of the lungs and blood is forced out of the heart. With the recoil of the chest wells air is taken into the lungs and blood into the heart. In this manner both artificial respiration and artificial circulation may be obtained, sometimes leading to immediate restoration of the normal functions of the heart and the respiration. This treatment should be begun at the earliest possible moment after the accident, and should be continued not less than 30 minutes. If it is a case of inhibition, that is to say, if the heart has been temporarily stopped by nerve influence, and the amount of current which has passed through the heart has not been sufficient to cause fibrillary contractions, the chances for recovery in most cases should be very good." While this is being done, an ambulance should be summoned and the proper officials of the company notified, but this should not interfere in the least with the work on the patient. On the arrival of the ambulance one man should be detailed to go with it and continue treatment up to the minute the patient is given into the hands of the hospital authorities.

One thing supremely important must be borne in mind, and that is promptness in applying restorative measures. As an illustration of the value of promptness in these cases, a case is recalled of a man who received a comparatively light shock, resulting in unconsciousness. After a period of about twenty minutes had elapsed after the shock the patient opened his eyes for a moment and moved slightly, and closed his eyes again, after which it was impossible to revive him. There is good reason to believe that if restorative measures had been promptly applied in this case death would not have resulted. It has been previously stated that death is due in these cases to either inhibition of the heart due to nerve influence, in which case resuscitation is possible, or to fibrillary contraction, in which case resuscitation is not possible.

In these cases another point of extreme importance should be borne in mind. That is, do not cease work upon a patient unconscious from electric shock until every known means for his resuscitation have been made use of. Surgeons who have made this a study tell us that men have revived after several hours labor, and in view of this fact it is little short of criminal not to use every means to bring the patient back to consciousness, or, perhaps, properly speaking, back to life. There is one other point in connection with the experiments previously mentioned that may ultimately prove of deep interest to the men engaged in electrical work. The fact was brought out as stated, that death does not necessarily follow an electric shock unless a certain amount of current passes through his heart. From this it will be readily seen that if some method can be devised for diverting the greater portion of the current around the heart, the number of deaths from electric shock will be greatly lessened, perhaps almost eliminated.

It is possible that this may be accomplished by means of a light metallic gauze jacket to be worn next the skin, or by a system of metallic bracelets worn around the upper arms and connected by means of flexible conductors to a belt of some similar material worn around the waist or some part of the body below the heart.—Read before the Ohio Electric Light Association.

PROGRESS OF ELECTRIC HEATING.

Our company have been paying considerable attention to this branch of the business for some time but did not do it systematically. A year ago we possibly had upon our system a dozen flat-irons in residences. About that time we began a campaign for the introduction of a flat-iron as a necessity rather than as a luxury, with the result that we have on the system to-day more than 600 irons consuming possibly seventy-five to ninety cents each, and in our case, being a water-power company, adding absolutely nothing to the expense except office expenses we have introduced these irons in laundries, supplying about eight laundries, the installation varying from fifteen to forty irons. We have displaced gas-irons in a town where gas is sold at ninety cents a thousand cubic feet upon a basis of three cents for the electricity. We find that three cents for electricity in an ordinary flat-iron is equivalent to about $1 a thousand, and our experience has taught us that laundries and families or any one else having to do with the particular apparatus will pay from ten to twenty-five per cent. more for convenience, quickness and cleanliness in the use of electricity as against ironing by any other method.

We have also—and I regret to say that I have not had time to tabulate this particular investigation—for a year past been experimenting with complete kitchen outfits in one of our towns, selling the current for this particular outfit at four cents per kilowatt-hour, with the distinct understanding that the family was to keep a daily record of what they cooked, how long it took to do it, and to read their meter before and after each piece of work, so that this, I take it, will be a somewhat valuable record for this association to have when the results of the experiment are tabulated. We find that the particular family which was given this advantage for the purpose set forth is satisfied with the result, and will from now on continue using this apparatus as against gas which it can buy at $1.50 per 1,000. The question was raised by one of the local companies as to the possible utility of using electricity in laundries in ironing. It seems to me that the experience of that company must have been particularly unfortunate, because this question has not been raised with any of the laundries upon our system. We have been supplying some of these laundries now for about a year.

We do find that electric irons, electric culinary apparatus, curling irons, and those small things which pay anywhere from twenty-five cents to fifty cents or a dollar a month to the central station company can be successfully introduced, but can only be pushed by personal solicitation. We engaged a woman who knew of the advantage of the apparatus, who said to us that she would go upon our system, and we are in a city where there are three competing companies, but that she would confine her work to our lines and would sell these irons for us upon a margin if we would let her have them at cost. We did that gladly and she introduced a great number of these irons for us. We let a lot of them out on a thirty-day trial, and out of the hundreds put out sixty-five per cent. stuck, and we believe this year our revenue from this sort of service will be increased not less than $10,000 a year without any appreciable expense to us.—A. I. Selig, National Electric Light Association Convention.

Mechanical Review of the Month

AN EPITOME OF THE WORLD'S BEST THOUGHT

MACHINE SHOP ROOFS.

Primarily, roofs are for the purpose of protecting buildings and their occupants from the elements, and in that roofs for machine shops are not different from roofs of other buildings; but for the machine shop the roofs may help to do many things besides, and while to do these things may call for a modification of the regulation style and even in some cases add to the cost, the gain will more than justify the modification. Assume, for example, a shop of the prevailing type—a central bay for the traveling cranes and wings and galleries each side. The roof over the central bay has no function to perform, nor can it well be made to serve any useful purpose except to ward off the elements, and no question can arise except: Is the usual form of construction the best and most economical?

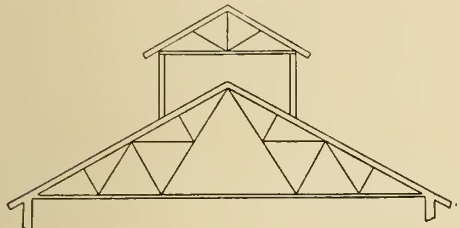


FIG. 1

Where wood is used for purlines and rafters, the protection against the spread of fire is greatly improved, and pockets between purlines and rafters are avoided. Where this form of structure is used for a foundry, as is common also, the question of ventilation or monitor construction presents itself, and the way in which this is often treated does not look well. (See Fig. 1.) The engineer who makes a roof that way may claim that it is simple, that it stands, and what more do you want? It is just in these points that the engineer lacks the training of the architect, who would do the job as shown in Fig. 2, which brings rigid points of support under the weight of the monitor and the length of the compression member is shorter. It looks right, and, like other things mechanical, when it looks right, it is pretty safe to conclude that it is right.

About sixty years ago, more or less, one Emerson designed a form of stationary ventilator, that no matter in which direction the wind blew, air would be drawn up the vertical pipe. This is shown in Fig. 3. The same principle can be applied in foundry or other buildings where ventilation is required, as shown in Fig. 4.

In the sections of shops where there are no traveling cranes, but line shafts, counters, pipes, etc., the trusses 8 or 10 feet between centres offer special advantages. Line shafts not over 2½ inches in size require supports and hangers as often as 8 feet, and 3-inch shafting as often as 10 feet, and there the frequent trusses supply a far better support than it is possible to get where trusses are 20 or 30 feet apart; and with the lower chords made as they should be, of two ell or channel irons, placed 5-8 or 3-4 in. apart, it is the most simple of all ways to bolt up hangers, counters or pipes. Bolts with suitable washers can be dropped down between the two parts of the lower chord, and any kind of attachment can be made in the least time and without trouble.

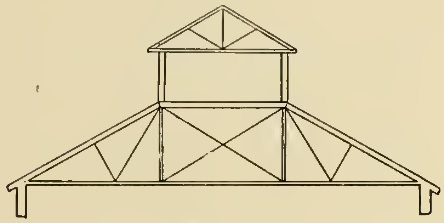


FIG. 2

It is well enough known by the designer of roofs that where the bracings are alternately long and short, the short ones are those that should be in compression and the long ones in tension.

This fact is often neglected, and it is not an uncommon thing to see designs like the one shown at the right-hand side of Fig. 5, and while that shown on the left side looks a good deal like it, it is enough different to be the difference between right and wrong. And, too, designers are so in the habit of using shapes for the various members as to ignore the advantage of flat bars for tension members.

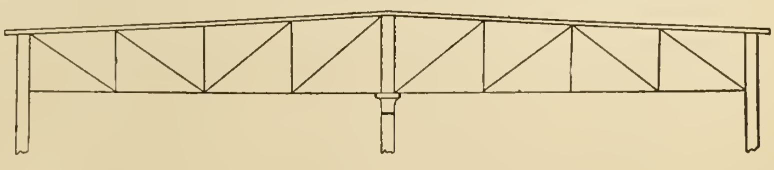


FIG. 5

The load on the long member is usually as much greater than the one on the short one as it is longer, and this calls for more rivets, and to meet this demand the wide flat bar furnishes the surface.—Cassier's Magazine.

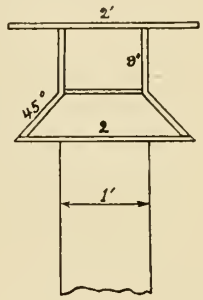


FIG. 3

DIAMOND CROWN RECOVERED.

The following is a description of work which came under the author's notice during the latter part of the year 1903. With the object of exploring the Van Ryn Reef, boring operations were commenced in 1902, on a farm on the far East Rand, about thirty-three miles from Johannesburg. When work had proceeded for more than a year, and the bore-hole had reached a depth of 3,233 feet, the bit became jammed, and the rods were consequently withdrawn. When the last rod had been removed the core-barrel, which was 40 feet in length, was drawn up. On its arrival at the surface it was found that the core-barrel contained no core, and that the shell and diamond-crown were missing.

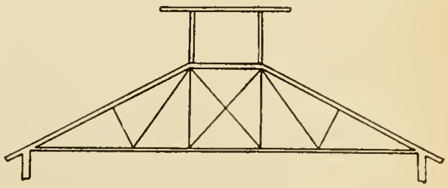


FIG. 4

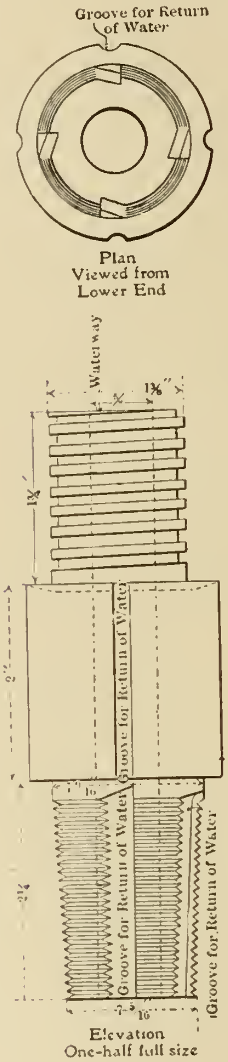
The shell is a piece of steel tubing about four inches in length, containing the spring which holds the core in position in the barrel, and it forms the connecting piece between the core-barrel and the bit or crown. The thread at the end

of the core-barrel, which screws into the shell, had broken off flush with the top of the shell. The core, with the exception of about $\frac{1}{2}$ inch at the bottom end, was recovered without difficulty, and the shell was recovered by means of a tap, cut short in order to insure its not being too long for the threaded tapered portion to grip the shell. When the shell was brought up, it was found that the crown had broken off from it, flush with the end of the shell, leaving its threaded portion within the shell.

In order to recover the crown a special tap was made in Johannesburg. This tool was six inches in length, of which $1\frac{3}{4}$ inches were threaded to screw into the end of the bottom rod; the next two inches consisted of a shoulder, 2 1-64 inches in outside diameter, to guide the tool, and contained four longitudinal grooves or waterways to allow the water to pass up outside round the edge of the bore-hole, and the remaining $2\frac{1}{2}$ inches consisted of a threaded tap, tapered from 19-16 inches to 15-16 inches in diameter. The tool was not solid, being 5-8 inch in inside diameter. It was made of steel, the end of the taper being softened to permit of diamonds being set in it. Four small diamonds (about $1\frac{1}{2}$ carats in all) were set in the end, in order to cut, within the crown, through and beyond the rock in which it was presumably imbedded. By the use of this tool the crown was speedily recovered. All the diamonds were found to be intact; there were eight diamonds on the face of the crown, four inside and four outside, and also four inferior diamonds round the outside of the bit, to keep the hole sufficiently large to insure easy working, and to prevent the bit from becoming jammed. The carbons, when recovered, weighed 17 53-64 carats, and were valued at more that £230, or £13 per carat; moreover, having been used, their quality had been tested, and reliance could therefore be placed upon them.

When the crown was recovered it was found to have been very badly burned, and to be worn down to only $\frac{1}{2}$ inch in depth, a new crown being $\frac{3}{4}$ inch in depth, neglecting the threaded portion. The bit having first broken off flush with the end of the shell, the two parts had been grinding against each other. As it was afterwards discovered that three rods had split at a depth of between 1,700 and 2,000 feet from the surface, it was concluded that the pressure-water, which is forced down through the rods and returns through the clearance-space between the outside of the rods and the side of the bore-hole, has escaped where the split occurred, and so had found a quicker and easier course to the surface. Thus no circulation of water had been taking place round the bit to keep it cool and to carry away the cuttings. The bit would thus quickly become jammed, and, probably weakened by overheating, would be unable to withstand the torsion to which it was subjected, and would, therefore, break, The fracture occurred in the lower quartzites of the Upper Witwatersrand beds.

The drill was a Sullivan machine, warranted to bore to a depth of 4,000 feet; the rods used were of steel, of English manufacture, in 10-foot lengths, which, at this depth, were unscrewed in 50-foot lengths for removal. The core-barrel was in two 20-foot lengths.



The risk involved in the accident was that the hole might have been abandoned entirely. This would have meant : (1) a year's work wasted; (2) probably nine months' delay before the same depth could again be reached in another hole; (3) loss of the total amount spent up to that time, about £8,000; (4) loss of £230 worth of diamonds; (5) loss owing to depreciation of plant and machinery for one year; and other incidental losses. —C. B. Horwood. Read at the Institution of Civil Engineers.

THE GAS TURBINE.

MANY engineers of considerable prominence have great faith in the utility and superiority of the gas turbine as a prime mover as shown by the large amount of speculative literature which has already made its appearance, and by the considerable amount of experimental work done to perfect such a motor.

The concensus of opinion seems to be that with ideal materials for constructive purposes, the gas turbine would be the most efficient motor, but that the present state of constructive art must be greatly improved before such a motor will be a successful reality.

The foregoing applies to the pure gas turbine, operating with what are known as fixed gases. When the combination of gas and steam is considered, the problem is altered and the difficulties reduced, both in size and number. Without discussing in the abstract the character of the new problem, consider the construction and action of what the designer calls a wet-gas turbine.

The combustion of the fuel, either gas or gasoline, takes place in the cylinders of single-acting engines, under the common Beau de Rochas or four-stroke cycle. The power developed in the four engines is transferred through gears to one central shaft, to which is also keyed the rotor of a radial-flow turbine.

In conjunction is also a boiler of the automobile type, using oil or gas as fuel, and supplying steam to the turbine along with the exhaust from the engines.

Two mechanically operated exhaust valves are used in each cylinder of the engine. During the larger part of the exhaust stroke, the gases pass at the high exhaust pressure to the inlet chamber of the turbine to which the steam is also led, and during the last portion of the exhaust stroke pass through the other valve to the atmosphere, so that the succeeding induction stroke is at atmospheric pressure, as is usual.

The boiler draws its water from the jackets of the gas engine.

Such an arrangement cannot be classed as a gas turbine, but are there not advantages to be derived from such a combination ?

The turbine constitutes the low-pressure end of the combination, and while the ultimate terminal pressure cannot be much less than that of the atmosphere and the number of expansions in the turbine small, the all-over efficiency should be large.

The high temperature of the exhaust gases serves to superheat the steam, which must be at the same pressure as the exhaust from the gas engine, and the interchange of heat likewise cools the exhaust gases to a temperature which is not harmful to the action of the turbine.—Power.

Carborundum the Modern Abrasive

By James G. Lorriman.

A LITTLE more than ten years ago a scientist, in making some experiments with an electrical furnace, produced a little bunch of bright diamond-like crystals which were chemically almost an exact counterpart of the most precious of gems. But it wasn't the real diamond, and therefore, from a scientific point of view, the discovery was considered of little value, Some practical men, however, who had noticed the hardness of the new material and the fact that it would even cut a diamond, saw that as an abrasive it could be made of considerable commercial value. Developments along this line began, and to-day the Carborundum Company of Niagara Falls, N.Y., have an enormous output of what is considered the most satisfactory abrasive yet discovered. It is the purpose of this article to describe the process by which carborundum is manufactured. and its utility in modern commerce.

The raw materials for this industry are granulated coke, glass sand, salt and sawdust, the latter of which is included for the purpose of making the mixture porous, and to allow the free escape of gas. These apparently irreconcilable materials are united to form a homogeneous mass, in electrical furnaces whose power is supplied from the mighty falls of Niagara, and whose heat, though unmeasured, probably approaches very nearly that of the sun itself.

Coke is used in two different sizes to manufacture carborundum kernels of certain size being used as the core, and a fine powder forming part of the mixture or charge for the furnaces. It first goes through a grinder, which breaks it up into small pieces, and then passes successively through two cylindrical screens, the first of which removes all particles of coke which are too small to form the core, while the second allows kernels of the requisite size to pass through the meshes and fall into the core-bin. Below the bin are scales on which sand, coke, sawdust and salt are weighed out in proper proportions, and conveyed by an elevator to a mechanical mixer from which the mixture, ready for the furnace, is emptied into a bin.

A furnace is in the form of an oblong box with internal dimensions of 16x5x5 feet, and the ends have a thickness of about two feet, while in the centre of each are terminals consisting of carbon rods. First, the side walls of the furnace are built up to a height of 4 feet, and half filled with the mixture, when a semi-circular trench is formed, to contain the ore, whose top is rounded off neatly so that it is in the form of a solid cylinder, 21 inches in diameter and 14 feet long. The walls are then continued to a height of five feet, and the mixture thrown in and heaped up to a height of about 8 feet. The electric current is now all that is required, and in this connection it is interesting to observe that the Carborundum Company have the second largest transformer in the world, reducing to the required voltage an electromotive force of 2,200 volts.

After the circuit is closed and the current turned on, no apparent change occurs in the furnace room for about half an hour. Then a peculiar odor is noticed, due to escaping gases, and when a match is held near the furnace walls, the gas ignites with a slight explosion. After about three or four hours of the electric current, the side walls and top of the furnace are completely enveloped by a lambent blue flame burning the gas formed from the carbon of the coke and the oxygen of the sand. Some time later the top begins to subside and fissures form along the surface, from which white hot cinders are often "blown" to a height of several feet. It is mainly to obviate this "blowing" that sawdust is introduced into the original mixture.

> **THE TEST.**
>
> ***"The man who is worthy of being a leader of men will never complain of the stupidity of his helpers, of the ingratitude of mankind, or of the inappreciation of the public. These things are all a part of the great game of life; and to meet them and not go down before them in discouragement and defeat, is the final proof of power."***
>
> —***ELBERT HUBBARD.***

After an operation of thirty-six hours the current is cut off from the furnace, and it is allowed to cool for a few hours. Then the side-walls are taken down and the top raked off until the outer crust of the carborundum is reached. This is cut through with steel bars and the inner crust then removed, disclosing the crystalline carborundum. From the core radiate beautifully colored carborundum crystals to a distance of 10 or 12 inches, and a single furnace will yield about 7,000 lbs. of these crystals.

Removed from the furnace, the carborundum is taken to a crusher which breaks the mass of crystals apart. Thence it goes to large wooden tanks and is treated for several days with diluted sulphuric acid to remove impurities. It is then thoroughly washed and graded according to the size of the crystals.

Carborundum is apparently infusible, for, after a certain temperature is reached decomposition commences without fusion, the crystals being broken up into carbon and silicon. This fact will probably serve to explain why carborundum so far as known does not occur in nature, even to a very small extent. It is also quite insoluble in water, or in any acid. Its hardness is somewhere between 9 and 10 degrees, that of the diamond being 10 degrees. Its specific gravity is less than that of emery, whence it is seen that a carborundum wheel is considerably lighter than an emery wheel of the same dimensions.

In making carborundum wheels, vitrified bond is used for the most part, the mixture being placed in a mould and pressed in a hudraulic press. After being removed from the mould, it is placed on a support made of baked clay, and the vitrifaction of the wheels is carried on in kilns similar to those used in making porcelain. This operation consumes seven days, after which the wheels are placed in lathes and trued up with dressers or diamonds. Another bond is shellac, which gives very satisfactory results for work requiring very thin wheels, or special forms.

At the present time carborundum is from two to five times dearer than emery, but it does more work, more quickly and satisfactorily. Watchmakers use it instead of diamonds, where emery and corundum would be quite unsuitable, and among its numerous other uses may be mentioned finishing the soles of shoes, manufacturing pottery and porcelain, and smoothing up "biscuit ware." In the manufacture of bath tubs, it has been found that carborundum rubbing blocks can do the work in one hour that emery would take a day to do.

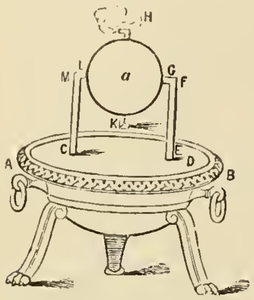
Thus the importance of carborundum as an abrasive can hardly be over-estimated. In foundries and machine shops carborundum wheels are by this time most extensively used; carborundum cloths and papers are a boon to carpenters and other mechanics, and carborundum knife snarpeners are being introduced into homes all over the country. In short, the unique qualities of carborundum have given it a pre-eminent position in the world of abrasives.

Despite the doubling of the import duty on agricultural machinery entering Australia, one of the largest consignments of reapers, binders, threshers and harvesters ever shipped from Vancouver left recently for Sydney.

*Harnessing Steam, 200 B.C. to 1784 A.D.**

By J. B. Berryman.

PROFESSOR THURSTON, in his "History of the Growth of the Steam-engine," formulates the axiom that "Great inventions are never, and great discoveries seldom, the work of any one mind." This is true of every branch of knowledge, and the develop-

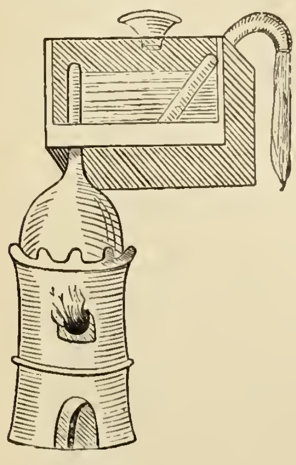


Hero's Engine, 200 B.C.

ment of the steam-engine has not been an exception. The process has been one of gradual evolution more than invention, each step forward making the succeeding one easier, until the centuries produced a man who could take the suggestions contained in the crude methods which preceded him, and by vivifying them with the force of his own genius, produce a mechanism which in all essential principles stands unaltered up to the present time.

Hero, 200 B. C.

The earliest record of steam, or heat, engines is found in a manuscript written by Hero, a learned mathematician of Alexandria, Egypt, about 200 B. C., en-

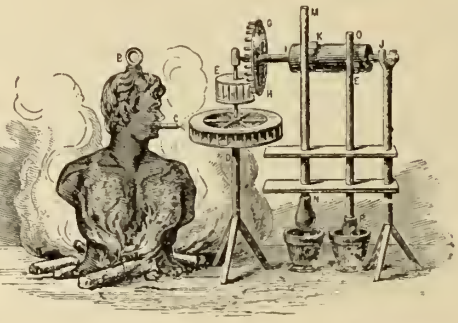


Porta's Apparatus, A.D. 1601.

titled, "Spiritalia seu Pneumatica." It is uncertain how many of the various ingenious appliances described were devised by Hero himself, as he states in the introduction his intention to describe existing machines and to add his own. It may be, therefore, that the steam toy known as "Hero's engine" antedated the manuscript on pneumatics by many years.

The operation of this little machine, called the "Aeolipile, is readily understood. The closed vessel, AB, was filled with water, and upon a fire being built underneath, steam was generated, which passed into the hollow globe, A, through the pipe, MC. This steam escaping through the bent pipes, H and K, which faced tangentially in opposite directions, the globe was revolved by the reaction of the current.

This contrivance appears to have been used to a limited extent as late as the seventeenth century for small powers. Bishop Wilkins, writing in "Mathematical Magic," issued in 1648, describes Aeolipile as familiar and useful apparatus. "They are," he says, "frequently used in the exciting and contracting of heat in the melting of glasses or met-

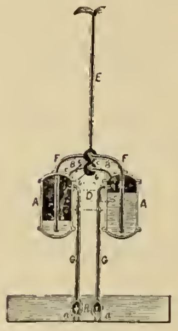


Branca's Steam Engine, A.D. 1629.

als. They may also be contrived to be useful for sundry other pleasant uses."

Hero also described several steam boilers of an elemental nature, the pressure being utilized to blow a horn, or make a bird sing, which seems to give the modern steam whistle an ancient, respectable pedigree.

From 200 B. C. to the sixteenth century practically nothing is found in any manuscript bearing upon the subject of steam. About 1550 Hieronymus Cardan, a physician, mathematician and mechanic, called attention to the expansive power of steam, and the vacuum which could be produced by condensation. In 1569 Jacob Besson, a French professor of natural philosophy published a treatise on the generation of steam and its properties. In 1571 Matthesius, in a sermon, described a steam power contrivance, and spoke of the power of a small quantity of confined vapor. About this time Leonardo da Vinci, engineer and painter, wrote a description of a steam gun, made of copper, which threw a ball weighing about 60 pounds. The steam was generated by permitting water in a closed vessel to fall on heated surfaces, and by the sudden expansion to eject the ball. In 1606 Giovanni della Porta published a treatise on pneumatics, in which he illustrated an appliance

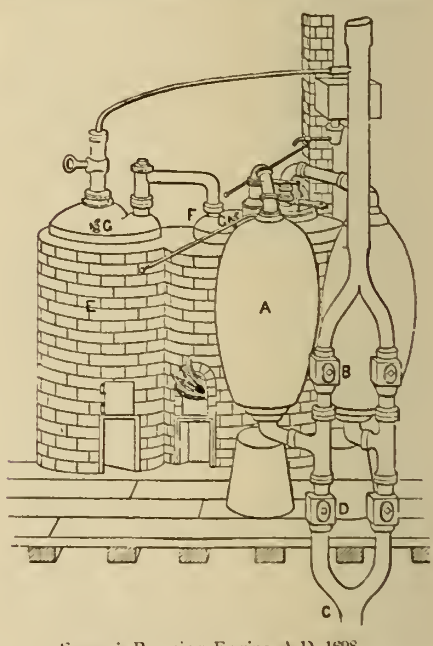


Worcester's Engine, A.D. 1665.

Wall of Raglan Castle.

similar to Hero's fountain but with steam instead of air as the displacing medium. He also pointed out that the condensation of steam might be used to produce a vacuum and suck up water from a lower level. His various suggestions were, a century later, applied by Savery to the first commercially successful steam pumping appliance.

In 1629 Giovanni Branca, of Loretto, Italy, designed the first steam turbine,



Savery's Pumping Engine, A.D. 1698.

which was made like a water wheel, and driven by the impact of a jet of steam on its vanes.

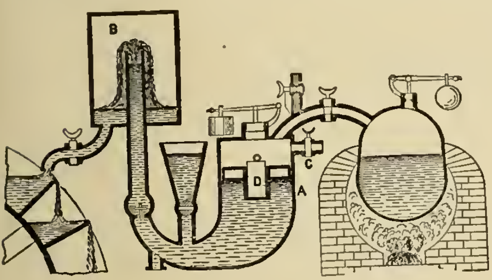
The idea contained in this apparatus has since been successfully applied by modern engineers.

In 1663 the Marquis of Worcester pub-

* For the reproduction of this article and the cuts Canadian Machinery is indebted to the courtesy of the Valve World.

lished a description of his various applications of steam to useful purposes, under the singular name of, "A Century of the Names and Scantlings of Inventions by me already practised." There are no drawings in the book, and the descriptions are so obscure that it is difficult to determine the exact form of the various apparatus. It would appear, however, that to the Marquis belongs the honor of proposing, or accomplishing, the raising of water, on a comparatively large scale, by the agency of steam. One of his accounts is entitled, "A Fire Water-work," and is couched in quaint language.

"An admirable and most forcible way to drive up water by fire, not by drawing or sucking it upwards, for that must be as the philosopher calleth it, 'Intra sphaeram activitatis,' which is but at such a distance. But this way hath no Bounder, if the vessels be strong enough, for I have taken a piece of a whole cannon, whereof the end was burst, and filled it three-quarters full of water, stopping and screwing up the broken end; as also the 'Touch-hole;' and making a constant fire under it, within 24 hours it burst and made a great crack. So that having a way to make my vessels, so



Papin's Modification of Savery's Engine, A.D. 1705.

that they are strengthened by the force within them, and the one to fill after the other, I have seen the water run like a constant fountain-stream forty feet high, one vessel of water rarified by fire driveth up forty of cold water. And a man that tends the work is but to turn two cocks, that one vessel of water being consumed, another begins to force and refill with cold water, and so successively, the fire being tended and kept constant, which the self-same person may likewise abundantly perform in the interim between the necessity of turning the said cocks."

The apparatus was actually used to elevate water for practical purposes at Vauxhall, near London, the materials being furnished by William Lambert, a brass founder. The biographer of the inventor suggests, after examining the walls of Raglan Castle, where the appliance was installed, the foregoing sketch as in accord with the description and evidence.

Worcester's Engine.

The two vessels, AA, were connected by the steam pipes, BB, to a boiler in the rear, the discharge pipe, E, is connected to the two vessels by the pipes, FF. GG are suction pipes with foot valves. Steam was admitted to the vessels, AA, alternately, and then condensing atmospheric pressure forced water through the suction pipes to fill them. While one was filling, the steam was forcing the water from the other out of the discharge pipe. One vessel being emptied the attendant cut off the supply of steam, and turned the current into the other, while the condensation of steam in the first one permitted it to fill again.

The Worcester machine anticipated the invention of Thomas Savery, 1698 to 1702, although the latter so far improved upon the details that the Savery "Fire-engines," as they were called, were used to quite an extent for raising water from mines, supplying houses, and towns, and even to drive water wheels.

Savery's Pumping Engine, 1698.

A serious difficulty, which prevented the more general use of the Savery engines in mines, was that the height to which water could be forced was limited by the pressure which the crude appliances of that early day would bear. It is surprising to find that pressures as high as 120 to 150 pounds per square inch were employed without even a safety valve. It was found no easy matter to deal with high-pressure steam, and Savery complained that it melted his common solder and forced him "to be at the pains and charge to have all his joints soldered with spelter." The machine was afterwards improved by the addition of a ball and lever safety valve, which was invented by Denis Papin in 1680, who also designed a modification of the Savery engine in 1705.

In this appliance water was admitted through the funnel. D was a floating piston to prevent sudden condensation from the steam coming in contact with the cold water. After the piston was driven down, the cock, C, was opened and the steam escaped. It was a non-condensing, single acting, steam pump, with the water and steam cylinders in one.

Papin invented the fire-box boiler, and also proposed to burn fuel on a grate within a furnace arranged with a down draught, the air entering above the grate, passing down through the fire, and from the ash-pit to a side flue in the chimney. He claimed that combustion was perfect, the formation of smoke entirely prevented, and the saving of fuel very great, all of which has a strangely familiar sound.

(To be continued.)

TO SET UP AND OPERATE A TURRET LATHE.

A FIRM in the United States, who are large manufacturers of turret lathes give information on this subject that is of value.

In setting up the machine it should be bolted with a floor before the belt is put on and its position should not be adjusted to the running of the belt. The machine should be set true with the countershaft or main line by dropping down a plumb bob from each end of the shaft. Since plumb bobs are not in the kit of every machinist an inch nut or any weight on the end of a string thrown over the end of the shaft will answer. The countershaft should line up perfectly with the shaft from which the power is received and it should be perfectly level. It should be well oiled before starting and examined after it has run fifteen minutes to see if any of the bearings are warm. Locate the stock supports and adjust them for height by placing a bar of stock in the machine and slowly revolving it. If the countershaft clutches slip, screw up the two small nuts at the rim of friction and slightly turn each the same amount.

The speed should be exactly as prescribed, if not the table of sizes of work for which the various speeds are intended will be of no value. Do not put your belts on too tight at first. It is much easier to lace the belt two or three times while it is stretching than it is to get a new bearing running smoothly after it has been roughened by the belts being too tight. All new bearings should be frequently oiled and run with care.

Starting.

To start the machine on bar work begin on some very simple work. Suppose the diameter of the head is one and thirteen-sixteenths and the body one and one-fourth inches, that the total length is six inches and that the piece must be finished all over. Get a bar of one and seven-eighth inch stock; see that it is fairly straight and free from short kinks and that there is no burr of any size on either end. If the bar has been cut off in the shear the burr should be hammered down. The large adjusting collar under the sleeve should be screwed back to open the chuck and forward to close it. Now remove the bushing from the spindle, for this is only used for smaller bars than one inch, and would not admit the one and seven-eighth inch bar. It is necessary to let back the rolls in the roller feed in order to remove this bushing. After

this is done push the bar through the stock supports into the spindle and through the chuck until the end projects about three-quarters of an inch beyond the face of the chuck. Adjust the jaws at the back of the roller feed till they are about one-thirty-second of an inch loose on the stock. Adjust the chuck until it requires much force to thrust the chuck lever to the left. The rolls of the roller feed should be set down against the bar till each spring is raised a trifle.

Operating.

Now the next thing is to determine the speed to be run. This can be done by the use of a table, or by experience. Turn the turret around until the cross slide comes in working position, set the cut-off tool and trim off the rough end of the bar. Before turning to the next place, set the stop.

Next move the "back-stop" up close and clamp it. Run the turret back against it till it turns to the next position; next loosen the back stop again and push it back till the end of the swinging "stock-stop" measures a distance equal to the length of the work which is six inches plus the width of the cut-off tool; which we call 3-16. That is, the stock-stop should be swung up into place and the turret should push the back-stop until the length between the end of the bar in the chuck and the end of the stock-stop is equal to 6 and 3-16 inches; then clamp the back-stop firmly.

Now open the chuck and hold the lever to the right until the roller feed pushes the bar out against the stop, then forcibly close the chuck. Turn the turret to turner. Now use the turner carefully and without the back rest, till the cutter is adjusted to size. This must be done on the first piece by use of calipers or any other gauge; take off about one-eighth inch chip each time while roughing, and allow it to run on about three-quarters of an inch.

After the end has been reduced one and a fourth adjust the back rest, have it follow the tool and bear on the one and a fourth size, then throw in the feed by the lever on front of the apron near the pilot wheel. Let this cut run up the required distance and adjust the feed stop for this tool. Before running back withdraw the tool by pulling the small cam lever towards you. Run back the turret until it brings the next tool into position and adjust this tool for turning the head of the piece; the head may be turned without the use of the back rest. Now the end of the piece may be shaped by the pointing tool held in one of the tool holders.

The screw cutting comes next. The next operation is rounding the head which may be done by an offset tool in the back tool post of cross slide, or it may be done by putting a crowning tool in place of the cut-off tool work from the back post of cross slide. By using the former instead of the latter an additional tool may be set in the back post for shaving the underside of the head. This, however, is not often necessary. Then cut the piece from the bar and proceed to run off the required number. If but one piece is desired it is not necessary to set any of the stops. These stops were set only for the benefit of more rapid production of the other pieces wanted. In starting the turner on a piece of this proportion do not throw in the feed until the edge of the back rest is started on the work. It should be fed thus far by hand. The fine feed should be used with a chip of this kind, but if the tool is beveled slightly, the medium feed can be used.

At the Noon Hour

The Joke on Dumas.

Dumas "pere," who was proud of the prices he received for his work, was once boasting of the fact.

"Beyond a doubt," he remarked, "I am the best paid of living men of letters ; I receive 30 sous a line."

"Indeed, monsieur !" said a bystander. "I have never worked for less than £5,000 a line. What do you think of that ?"

"You are joking," responded Dumas, in irritation.

"Not at all."

"For what do you receive such rates per line ?"

"For constructing railways," was the answer.—Harper's Weekly.

Vanderbilt Couldn't See It.

When George Westinghouse, the Pittsburg inventor, had completed his airbrake, he submitted it to Commodore Vanderbilt, with the object of installing it on the commodore's railroads. He was only 23. He was admitted to the great railroad manager's office and permitted to explain his mission while the commodore opened his mail. Occasionally Mr. Vanderbilt uttered a grunt merely to signify that he was listening to the enthusiastic recital. When the inventor paused, Vanderbilt was ready with his decision.

"Young man," he said, "do I understand that you propose to stop a train of cars with wind ?"

Westinghouse admitted that was the fact.

"Well, young man, I have no time to bother with d—— fools," declared the commodore.—American Illustrated Magazine.

'Twas Work Too.

Prof. Nichol, the Cornell physicist, during the recitation of a freshman class in natural philosophy, observed a tall, lanky youth in a rear seat, his head in a recumbent position, his body in a languid poise, his eyes half closed and his legs extended far out in an adjacent aisle. He was either asleep or about to lose consciousness.

"Mr. Frazer," said the great scientist, "you may recite."

The freshman opened his eyes slowly. He did not change his somnolent pose.

"Mr. Fraser, what is work ?"

"Everything is work," was the drawling reply.

"What ! Everything is work ?"

"Yes, sir."

"Then, I take it, you would like me and the class to believe that this desk is work ?"

"Yes, sir," replied the youth wearily, "that desk is woodwork." — Cornell Widow.

Seeing By Telephone.

"How well you're looking this morning !" says the facetious man in telephonic greeting to his friend a hundred miles away. Mr. J. B. Fowler, of Portland, Oregon, has taken the nub out of this joke by inventing an apparatus by which images displayed before a lens at one end of a telephone wire are projected upon a screen at the other end. Mr. Fowler invites his visitors to talk with his daughter. They place the telephone transmitter to the ear, apply the eye to an aperture in the telephone box, and see the young woman in miniature speaking 5,000 feet away. Mr. Fowler is preparing now to show a train in motion in his invention. He has no doubt of its commercial practicability, and declares that within a few years it will be in operation throughout the country. For some it may be a boon. For others it will be a curse. Who has not telephoned when he wanted to avoid a face-to-face interview ? What will frisky husbands "detained at the office" say to a machine that shows to suspicious wives the chips that pass in the night ? Mr. Fowler may not be a public benefactor after all.—Everybody's Magazine.

Iron Pipe Connections

By M. J. Quinn.

FOR the benefit of those who are not constantly working on iron pipe, and who are not familiar with all of the devices used for making final connections between two sections of work, or of the particular adaptations of each of them, it is thought that a short dis-

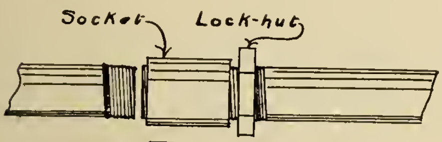


Fig 1

cussion in connection with the accompanying illustrations may not be amiss.

Figure 1 shows a "socket and lock-nut connection, which is made by threading one piece of pipe a sufficient length to allow a lock-nut and socket to be freely screwed on until the end of the pipe comes through to the outer face of the socket, so that when the two pieces of pipe to be connected together are placed opposite each other, as shown in figure 1, the socket may be unscrewed off the long thread on to the short one, until it is perfectly tight on the latter.

The lock-nut is then unscrewed until it is within three or four threads of the socket, when the space between the two is tightly wound with cotton wick, which has first been well oiled. Then the lock-nut is still further unscrewed, until it is made tight against the end of the socket, and a certain amount of the cotton wick having been squeezed into the thread and between the lock-nut and socket, makes a good joint at that end of the latter.

Figure 2 shows a lock-nut connection which is used where a socket is not required, as for instance where fittings

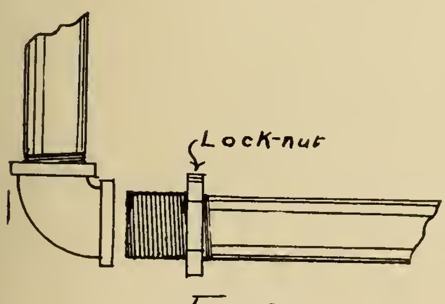


Fig 2

such as elbows or T's are to be connected together. In this case the "running thread," as it is termed in the steamfitter's parlance, is made a little more than twice as long as the ordinary thread, then a lock-nut is screwed up to the "butt," the running thread is then screwed into a fitting twice as far as it would go ordinarily, when, if it be screwed back into another fitting until it is right in the latter, there will be several threads of the running thread still remaining in fitting into which it was first screwed.

After the thread on the opposite end of the pipe has been "made up" tight the lock-nut is then screwed up tight to the face of the fitting, the fitter having first introduced the cotton wick before referred to.

Regarding the connection shown in figure 2 it may be mentioned that, where possible, it is better to use a "T" than an elbow, as the running thread has a tendency to strike the back of the latter, though, when necessary, the elbow may be used.

Figure 3 represents a "union," which is made in three pieces, one piece each for the ends of the pipes to be joined together, and a coupling ring, which in the illustration is shown lying loose on the pipe to the right of the coupling. The

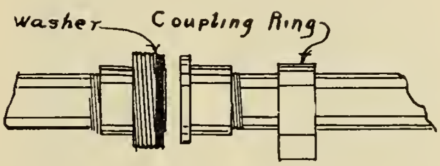


Fig 3.

means of connecting the coupling is to first place between the two pieces screwed on the ends of the pipes a washer of leather, rubber, lead or other soft substance, and then to draw them together with the coupling ring, which, by screwing up on the thread of the end farthest away from it, draws the two ends together and tightens them against the washer.

This style of connection does very well for gas, or water at an even temperature, but where there is a constant variation in temperature the expansion and contraction in the metals is liable to cause the washer to become loose, and in that way to leak.

The latter objection is overcome in the connection shown in figure 4, which is called a "right-and-left connection." It is made with a socket having in one end a right-hand thread, and in the other end a left-hand thread, one pipe having a right thread and the other a left thread to correspond, and they are put together as follows :

Screw the socket up on one pipe as far as is necessary to make it tight, then draw a chalk mark on the socket, and one on the pipe, both being in a line. Then slowly unscrew the socket, counting the number of revolutions which it makes, and mark down the result. Repeat the operation on the other thread and mark down the revolutions in the same way.

Now assuming that the right thread made six revolutions and the left thread

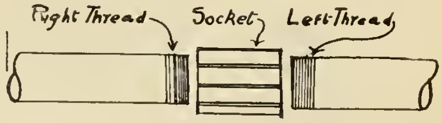


Fig 4.

made only four revolutions, the socket would have to be screwed two threads on the right thread, leaving still four threads or revolutions to be turned before it would become tight, and if both ends are then drawn together and the socket turned four revolutions it will become tight at both ends.

The great advantage of this connection is that it is iron to iron when "made up," and will be as safe as any other part of the piping system.

Elbows are also made with a left thread, so that using a piece of pipe between two fittings, the latter taking the place of the socket, the same results may be obtained.

The connections mentioned so far are those which are used on all sizes of pipe up to 2 in. in diameter, and that shown in figure 5, which is known as a "flange" joint, is made of two flanges, one of which screws on each end of pipe to be joined together. A thin washer is placed between them after they have been screwed up tight on the pipes, and then they are drawn tightly together by a series of heavy bolts and nuts arranged around the outer edge.

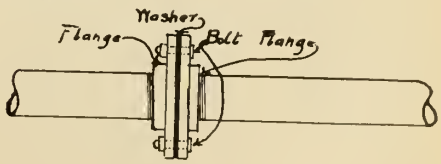


Fig 5.

NEW FOUNDRY BUILDINGS.

Forwell Bros., Berlin, are preparing the plans for their foundry site and buildings will be erected as soon as possible on the lot in Woodside Park. The two main buildings of the foundry will be of brick; one 52x100 feet, and a second 35x100 feet. There is to be a stock shed 20x65 feet and a metallic supply shed 18x115 feet. These buildings will cover over 12,000 square feet.

Manufacturers' At Quebec

Notes on the Annual Convention in the Ancient Capital.

IN certain respects the 34th annual convention of the Canadian Manufacturers' Association, which opened in Quebec on Monday, 18th September, was not attended with the full measure of success that usually characterizes both business and social functions of the organization. The registration list showed an attendance of only a little over 150 delegates, whereas 100 to 150 more were expected. The pre-arrangements of the good people of Quebec were excellent. They could scarcely have been better, and the proof is that everything went off without a hitch.

The convention proper opened on Monday afternoon at 2.30. President W. K. George occupied with becoming dignity the imposing chair, or rather, throne, of His Worship le Maire of Quebec. Secretary Younge, with equally becoming dignity, occupied a seat at his right, and the benign finance minister of the association, Treasurer Booth, sat at his left, while on the front benches, taking a fatherly interest in the proceedings, were ex-President W. K. McNaught, fresh from his victories at the Canadian National Exhibition ; Vice-President Ballantyne, Montreal ; ex-Secretary T. Russell, Toronto ; Mr. George Amyot, Quebec, and other veterans.

President George did not waste any time in preliminaries, but at once got down to business, the report of the treasurer being the first item on the programme. Treasurer Booth does not present his report after the manner finance ministers do their budget speeches. He does not attempt to make things appear better than they really are. He did not mince matters when he said that while there was a balance in the bank of $4,250 at the end of the financial year, and that the association possessed a surplus of over $6,000, the expenditures had increased at a greater ratio than the membership, rapid as that increase had been. He was so earnest about this that he asked for an expression of opinion from the convention as to the advisability of increasing the membership fee. This led to the most important discussion of the afternoon. The consensus of opinion was in favor of something being done, but just what demanded careful consideration. It was felt that nothing should be done that would tend to impair the membership.

Secretary Younge's report was noted for two or three suggestions it made. One was to the effect that although the membership of the association had increased by 328 during the year "it was absolutely necessary for something to be done to increase the membership fee." In this it will be seen he concurred in the suggestion of Treasurer Booth. The other was recommending the appointment of a traveling secretary.

The report of the parliamentary committee, whose duty is to keep an eye on Provincial and Federal legislation, showed that that committee had not slept—at any rate, when it should have been awake. And by keeping awake, some objectionable legislation had been prevented. There was one thing, however, which the committee had not been able to prevent, and that was the tax which British Columbia and Quebec had imposed on commercial travelers. The report deprecated the tax and the members of the convention who spoke in regard thereto endorsed its sentiments.

Mr. C. C. Ballantyne, Montreal.
The New President of the Canadian Manufacturers' Association.

Before 10 o'clock on Tuesday morning the convention was at work again considering reports. The report of the Fire Insurance Committee recommended that authority be given that department to conduct an insurance brokerage for placing the insurance of the members of the association and was productive of a great deal of discussion

What is generally conceded to have been the best report submitted to the convention was that presented by the Railway and Transportation Committee showing that the efforts of the committee had been productive of results most beneficial to the members of the association. For example : On behalf of the Metallic Roofing Co. the committee had made representations to the Board of Railway Commissioners in regard to classification of metallic shingles, and the result obtained; according to the statement of the manager of the company who was present, was the saving of about $3,000 a year in freight rates.

In the evening Quebec did itself proud. The weather outside was disagreeable, but the arrangements for the entertainment of the guests were so elaborate and complete that within the town hall, where the public reception was held, the unpleasantness of the outside was forgotten. Addresses of welcome were made by Mayor Parent and Mr. G. A. Vandry, and responded to by Mr. W. K. McNaught, after which President W. K. George delivered his annual address. It was a masterly effort. Dancing followed the speech-making.

On Tuesday evening a reception was tendered the party at Spencerwood by Lieut.-Governor Jette.

The chief interest in the election was, of course, centred around the contest for the vice-presidency. There were two aspirants for this office, namely, Mr. J. O. Thorn, of the Metallic Roofing Co., Toronto, and Mr. Harry Cockshutt, of the Cockshutt Plow Co., Brantford. Both gentlemen have been energetic workers in the interest of the association and both had a large number of friends. Mr. Cockshutt, however, was the choice of the convention for the office, the holder of which naturally steps into the chief executive office the following year. Mr. Cockshutt has just returned from a six months trip to Australia, while Mr. Thorn has been in Winnipeg for some time on business and is still there.

The banquet on Wednesday night at the Chateau Frontenac was particularly unique in one respect and that was in regard to the speeches delivered. Certainly at no previous banquet of the association was there such a galaxy of brilliant speakers. Hon. Mr. Lemieux, the Solicitor-General of the Laurier Cabinet, delivered an address the eloquence of which will not be forgotten by any one privileged to hear him. Then there was the silver-tongued Sir Wilfrid Laurier, the Hon. Mr. Fitzpatrick, Attorney-General of the Laurier Cabinet, Hon. R. L. Borden, leader of the Opposition, Lieut.-Governor Jette, to say nothing of the excellent addresses delivered by such members of the association as President Ballantyne, ex-President Geo. Drummond, and Mr. Edward Gurney

PERSONAL MENTION

Mr. Samuel S. Buckley, of Syracuse, New York, an expert metallurgist, is at present making a tour of Canada in the interest of Sanderson Bros. and Newbould, Limited, Sheffield, England. He is introducing some of the high-class tool steel manufactured by this company, and has met with signal success on this his first business trip to Canada.

Mr. A. B. Allan, of Allan Whyte & Co., Glasgow, Scotland, is in Canada. He is here to extend his Canadian business and spoke very hopefully of the future of the firm's interests in this country. Allan Whyte & Co. are contractors to His Majesty's Government, and own the Clyde Patent Wire Rope Works of Rutherglen, Glasgow. They are also manufacturers of wire rope for collieries, mines, aerial tramways, etc. Their representatives in Canada are : Wm. Stairs, Son & Morrow, Halifax, N.S.; W. H. Thorne & Co., Limited, St. John, N.B.; Drummond, McCall & Co., Montreal, and John Burns.

Mr. W. T. Standish, who has been connected with the A. R. Williams Machinery Co., Toronto, for the past five years, has decided to go into business for himself as manufacturers' agent. At present he will devote his attention chiefly to small tools and specialties, including a line of special drill chucks, and also a ball bearing for small work. Mr. Standish has an intimate knowledge of the machinery trade, and being young and enthusiastic it will doubtless not be long before he has an assured position among manufacturers' agents. Although Mr. Standish will be traveling for the most part, he is making Toronto his headquarters.

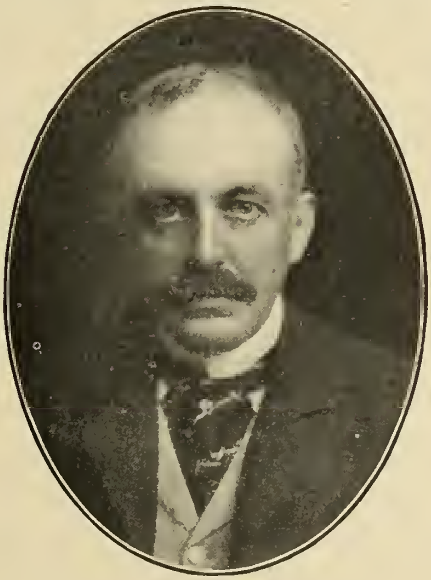
Mr. A. E. Peters, general manager of the Record Foundry & Machine Co., returned to his home in Moncton recently, after a three months' trip west. Mr. Peters spent some time in Chicago, Omaha, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle, Victoria, Calgary, Winnipeg, Fort William, Sault Ste. Marie, and many other places of interest. In the west Mr. Peters procured several advertising pamphlets used by different boards of trade in some of the cities he visited, and it is expected that many of the ideas gathered during his trip will be adopted by the Moncton Board of Trade.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Co., returned on the 8th inst. from Europe where the past six weeks were spent in the interest of the foreign business. While abroad the Fraserburgh and Berlin factories were started up and manufacturing arrangements perfected in Russia. All factories are now running in good shape with sufficient business to keep them constantly occupied for several months, and the outlook generally is the most satisfactory of any period in the history of the company. Mr. Duntley states the foreign business promises during the next few years to rival the American business.

LEADING SPIRIT IN NIAGARA DEVELOPMENT DEAD.

"Death loves a shining mark, a signal blow."

YOUNG'S words were probably never more fittingly applied than in referring to the death of William B. Rankine, at Franconia, N.H., on Sept.



The Late William Birch Rankine.

30th. To him more than to any other man the present electrical development at Niagara is due, the pioneer work of which stands as a monument to his energy and genius. His was one of the brightest minds to be found anywhere and his sudden taking away can be considered a national calamity.

Mr. Rankine was born in Osewgo, N.Y., in 1858, and educated in Hobart and Union Colleges, from both of which he held the degree A.M. He was called to the bar in New York in 1880, where he practiced for ten years. In 1890 he interested himself in Niagara Falls development and soon the influence of his master mind was felt. At the time of his death Mr. Rankine was second vice-president and treasurer of the Niagara Falls Power Co., the Niagara Junction Railway Co. and the Niagara Development Co., vice-president of the Canadian Power Co., president of the Clifton Hotel Co., Limited, of Niagara Falls, Ont., and a director, stockholder and officer in a large number of corporations and clubs.

The subject of this sketch in his personal character and attainments was, according to one who knew him most intimately, almost unique. He was one of whom high and low spoke with unvarying respect and kindness. To a great business acumen he brought a high ideal of how his duty should be discharged. It was said of him that he was essentially a gentleman and gave tone upon every occasion to any company in which he was found. He was a man of the most simple and quiet courtesy, who solved the most difficult problems in discussion without heated debate or argument, and yet with a tenacity which never yielded in the right. He has been compared more than once to the diplomacy which has made the name of John Hay world famous, always being direct, simple, frank, and the thought in his heart corresponding absolutely with the utterance on his lips. Business men might well learn a lesson from both these lives, which have been so unfortunately for their country, blotted out. Mr. Hay introduced a new era in diplomacy, by going straight to the point without circumlocution or ambiguity. Mr. Rankine in the business affairs of Western New York introduced a frankness and honesty which won the confidence of everyone with whom he was brought in contact. He had nearly put upon a firm footing all the details connected with his great life work about Niagara, and was about entering upon a period of leisure from which the public would have received some of the benefits which his business associates had already reaped. A year ago he was appointed Chancelor of the Diocese of Western New York. He was one of the trustees of DeVeaux College, and a life trustee of Union College, and had expressed himself as feeling able to respond to the many calls which were being made upon him by institutions of learning and charity to give them the benefit of his business training and great intellectual capacity. He was as witty as he was wise, and of him it is widely said as Byron said of Sheridan,

> "....Nature made but one such man
> And broke the die in moulding Sheridan."

CANADIAN

MACHINERY

AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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Vol. I. OCTOBER, 1905. No. 10

OPPORTUNITY IN CANADA.

I think that Canada is on the eve of her greatest transportation development. In the next ten years there will be more miles of railway built in Canada than in the last twenty-five.

I agree with Sir Wilfrid Laurier that the Grand Trunk Pacific will be followed by a third and a fourth transcontinental railway and they will all do well.—C. M. Hays, President of the Grand Trunk Pacific Railway.

The above, from a man who has won recognition as one of the best authorities, one of the shrewdest judges of railway problems in Canada, is well worthy of consideration.

It means that towns, villages and cities will spring into existence; that whole townships and counties, now untilled, will be made to yield bountiful harvests; that a great stream of emigration will pour into Canada, from the Western United States as well as from Europe. It means that industry and commerce in the eastern Provinces will thrive as they have never thrived before.

What does it mean to you ?

Canadian manufacturers, what are you going to do about it ? Are you going to grow with the country and get your share of the increased business ? Or will you "let things slide" and let your competitor take the pick of the new business ?

With equal timeliness the question might be put to foreign manufacturers who are selling a fair proportion of their output in Canada, in the face of the prevailing duty. What does this mean to you ? Nine chances out of ten it means that either you or your competitor will establish branch works in Canada. Why should it not be you ? The market here is, or very soon will be, big enough to make it worth while.

Every firm doing business in Canada to-day should at least double their sales in ten years. This should mean much more than doubling their net profits or incomes.

VALUABLE SERIES OF ARTICLES.

ONE of the difficulties in connection with the publication of a technical newspaper is the presentation of reading matter that will be of greatest good to the greater number of its readers. Many articles suggested or submitted, do not come within the scope of the field covered and others are written in a manner least calculated to interest or benefit the subscriber. From the publication of the first issue of Canadian Machinery our aim has been to make it not only bright and attractive from a news standpoint, but essentially educative as well. It is therefore a pleasure to announce the commencement in this issue of a series of articles of the most practical and instructive nature. They are written by Mr. W. H. Reaburn, of Dundas, designing engineer at the machine works of John Bertram & Sons, Limited, in a clear and comprehensive manner, with a notable absence of formulae and involved mathematics. Anyone desirous of becoming well acquainted with the principle of applied mechanics with little effort would do well to follow this splendid series on "Practical Mechanics."

LABOR TROUBLE NEARING END.

PRESENT indications point to an early settlement of the long standing difference of opinion between the officials of the Grand Trunk Railway system and the machinists employed in their different shops. During the third week of September Sir Wilfrid Laurier met Mr. Chas. Hays, president of the G.T.R., in the interests of the machinists with a view to bringing about a settlement and bring to an end the existing unsatisfactory state of affairs. The company maintains that the men, with very few exceptions, have been taken back and hence they have nothing to discuss. This, according to the representative of the International Association of Machinists, is not the case, as a large number of their men are still out, not only at Stratford, which is the centre of the trouble, but also at Port Huron, London, Toronto, St. Thomas, Belleville and Montreal. The Department of Labor have taken up the matter and it is expected that a conference of the contending parties will be called at Ottawa when the various phases of the situation will be discussed and settled, the Government acting as arbitrator.

The trouble dates back to the 8th of April last when the International Association of Machinists were preparing to present to the officials of the railway company a schedule of rates such as has been adopted by other railway systems, but the company immediately ordered a lock-out. A month later a general strike was declared and this condition of affairs is still maintained. It is satisfactory to note, however, that a speedy settlement seems assured.

EXPANSION IN MACHINERY MANUFACTURE.

CLOSELY following the announcement in last month's issue that Niles-Bement-Pond Co. had secured an interest in the Bertram works at Dundas, Ont., came the assurance that additions were proposed. Already work has commenced on a large foundry of modern design, which will mean the em-

ployment of more men and greater increased capacity.

The Jenckes Machine Co., of Sherbrooke, Quebec, finding they must expand their works to keep pace with the growth of business, decided to build an entire new plant at St. Catharines, work on which is already in progress. Here will be manufactured the same lines as at Sherbrooke for the western trade.

It has been known for some time past that the London Machine Tool Co., of London, Ont., intended building a new plant, but no definite decision as to location was reached until very recently, when it was decided to locate in Hamilton, Ont. The contract for the new premises has already been let, and the firm expects to occupy them on the first of January.

MACHINERY MARKET ACTIVE.

IN looking over the Canadian field an eminently satisfactory condition of affairs is noted in the machinery market. At each of the different centres—Montreal, Ottawa, Toronto, Winnipeg and Vancouver — dealers and manufacturers report sales and output of a larger volume than formerly. The general tone is reflected in a remark made by the head of a large manufacturing concern, when he said, "While business is indeed satisfactory in comparison with former years, we are looking forward to and making preparation for an amount of business in the next few years in comparison with which the present amount seems small. It must come. The expansion of the country is bound to bring it about. We are in the business on business principles, and expect to get our fair share of what the future promises." There is no doubt but that the sentiment thus expressed will be liberally fulfilled.

SYSTEMATIC WORKS MANAGEMENT.

EFFICIENT handling of material from the time it enters the works in its raw state until it emerges as the finished product is an important consideration for the works manager of any manufacturing plant. There is scarcely a manufacturing establishment where considerable thought has not been expended along this line, primarily in the arrangement of the various buildings, and secondarily in the installing of traveling cranes, jib cranes, industrial railways, and in the systematic arrangement of machine tools. More or less success has been attained in the various plants, but in very few is there continual and economical progression of material through its various stages of manufacture. In the new works of the Canadian Westinghouse Co., Hamilton, which works are described and illustrated in detail in another part of this issue, is exemplified in a very efficient manner the economical progression of material from start to finish.

The pig metals are unloaded from cars on a Grand Trunk siding and are stored in compartments along the wall of the foundry building. Patterns come from the pattern shop direct to the foundry. Finished castings leave the foundry and enter the machine shop, the stationary parts of the machines progressing up the general shop from tool to tool until the erecting floor is reached, while the rotating parts progress up through the small machine shop, close to and running parallel with the general one, until they, too, reach the erecting floor. The means of conveyance in the general shop is a large traveling crane. The small shop is also provided with a traveling crane, the material being switched over to the erecting floor by means of a jib crane. From the detail machine shop on the other side comes the detail parts of the machines, which are landed on the erecting floor by means of industrial railways and electric elevators. Here the machines are completely erected, and are passed on to the testing floor, and thence to the shipping floor, where they are finished, boxed and loaded onto cars on the siding running into the shipping department.

Thus the erecting floor is a hub, so to speak, to which parts of the machine are delivered on three sides, the erected machine leaving by the fourth side for the testing floor. There is no chance of any part of the machine going astray or being sidetracked and neglected with this exact system of handling material, since each part of the completed machine has a set channel for its travels; nor do these channels in any way interfere with each other. The arrangement of the buildings is also very systematic, and the facilities for expansion are such that additions can be made without interfering with the general arrangement of the existing departments. This feature of facilitating expansion is in every way as important a consideration in the design of works as the detail arrangements of the already constructed plant.

ATTRACTING MANY INDUSTRIES.

HAMILTON, situated at the extreme west of Lake Ontario and about forty miles from Niagara Falls, has for its size attracted more industries within the last couple of years than probably any city in Canada. The reason for this is not altogether due to favorable location, but more so to the enterprise of the public spirited citizens of the place. They realized that this was Canada's growing time and made the most of it. It was not by holding out alluring baits that most of the enterprises were secured, but by having a straight business proposition to offer to any firm inquiring concerning manufacturing conditions within the municipality. When a manufacturer expressed his desire to look into conditions he was invited to pay a visit. When in the city he was taken over the ground and shown exactly what the city had to offer, told within a few dollars of what the land would cost, what would be his taxes, and any other information that a manufacturer needs must know when considering the cost and possibilities of a new enterprise. This spirit on the part of the officials of Hamilton met with a quick recognition and no doubt due to this fact many of the new industries are now located there. The building of so many plants and bringing in such a large number of workmen within such a short space of time has given rise to a serious problem regarding workmen's houses, but this is being rapidly overtaken, and street after street of attractive dwellings have been and are still being erected to provide for this contingency. Among the new industries recently attracted to that city are the London Machine Tool Co., the Canada Meter Co., the Union Drawn Steel

Co., Canadian Drawn Steel Co., Samson Elevator Works, Petrie Mfg. Co., F. W. Bird & Sons, Holton Shovel Works, Canadian Tool & Shovel Co., and the Canadian Westinghouse Co., all of which are in a prosperous condition and employing from a few dozen up to about 1,000 men.

ASSISTING THE WORKMEN.

A SUGGESTION made by Mr. Alex. Fleck, of Ottawa, and put in practice by him at his works, is well worthy of being followed out by other manufacturers and employers of labor. Mr. Fleck realizes that a greater knowledge and more thoughtful appreciation of his work on the part of the mechanic must necessarily result in better workmanship, and the higher standard of excellence. With this end in view, and for the benefit of those in his employ who did not feel the necessity, or possibly felt unable, to subscribe for a technical paper, Mr. Fleck has placed on one of the benches during the noon hour a file of Canadian Machinery so that those who would not otherwise see the paper may have a chance to read it and be benefited thereby. This act of kindness on the part of their employer is greatly appreciated by the men and many a company whose experience with their workmen has been none too cordial would find that just such acts tend to change almost entirely the relationship between employer and employe.

OTTAWA'S WATER POWER.

OTTAWA is the one city of importance in Canada where an enormous water power is available well within the corporation limits. At the present time a serious dispute is under way regarding the manipulation of the waters approaching the Chaudiere Falls at which this water power is derived. Early in the season the manufacturers on the south side of the river, including J. R. Booth, the Ottawa Electric Co. and others, commenced deepening the channel just above their intake to allow a better supply to enter their flume. This was taken exception to by the E. B. Eddy Co., on the north side, although the engineers claim that the water being divided by the island at considerable distance above this the flow going to the north side was in no way affected. Steps were taken to bring out an injunction against the parties deepening the channel but this was not sustained, and the work of blasting out the rock is under progress. The matter of deciding the dispute should rest with the Dominion Government, although the lessees on the Quebec side of the river claim that it is purely a Provincial matter. What would be most logical in view of the existing circumstances would be for the Dominion Government to assume control and take steps towards effecting a settlement. This could easily be done by metering the river and finding out what each of the different power users at present consume, building a dam and then charging all lessees at a certain rate on all over and above what they are at present consuming. This would overcome not only the present difficulty but avoid the possibility of any misunderstanding in the future.

LETTERS TO THE EDITOR.*

Quebec, Sept. 4th, 1905.

To the Editor of Canadian Machinery,
Montreal.

Dear Sir,—I have just read with interest your article in the August issue of your paper entitled "Do we want the metric system ?"

I think that every manufacturer should make a study of the matter and this can be easily done by the perusal of the very comprehensive lecture by Professor J. C. McLennan, of the University of Toronto, a copy of which I mail you under separate cover.

Our country is now passing through a period of wonderful and extraordinary development and there is no doubt that it will cost much less to adopt the system now than what it will cost to do so later, when the population of the country is up in the fifty millions with an industrial development in keeping.

I think the publication of Professor McLennan's lecture in your paper and all the industrial and other papers in the land will help the passing of the law. By a glance at the calculations any one can see how simple the metric system is compared to the one actually in use.

For my part I say let us clamor and clamor again to have the law passed as soon as possible. Yours truly,

J. F. GUAY.

356 W. 120th Street,
New York, Aug. 27, 1905.

Editor Canadian Machinery :

I notice by your last impression that the metric party has been blowing some of its "hot air" in your direction. It seems to me that it is time for the pretensions and expectations of the metricites to be taken at their face value as those of a party of enthusiasts whose sky is filled with rainbows and whose future contains nothing but visions of the imagination.

For half a century, according to these gentlemen, the adoption of the metric system by the English speaking world has been a matter of the immediate future. The legalizing of metric measures by Great Britain and the United States was due to their efforts, and, according to their expectations, the manifold advantages of the system were to lead to its general adoption as soon as its use was made legal. Finding, however, that the system made no progress in industry and commerce so long as the people were allowed to choose the units which they could use, they have turned to compulsion. Three years ago they had made such progress in the United States as to have secured a favorable report of their bill to the House of Representatives by the Committee on Coinage, Weights and Measures, the vote of the committee standing 16 to 2 in favor of the bill, and all Anglo-Saxondom rang with their prediction of the immediate passage of the bill. The report of the bill, however, served only to arouse the opposition, which placed such an array of testimony before the committee as to kill the bill, and to-day, as a subject of legislation, the metric system is the "deadest" thing in this country.

Substantially the same series of events is now being repeated in England. The passage of a metric bill by the House of Lords has served to develop a previously latent opposition. The Decimal Association is half a century old, while the Anti Metric Weights and Measures Association has been in existence but a single year. With no organized opposition, the former based great expectations on its success before the House of Lords, but the progress of the bill has been completely stayed now that effective opposition has shown itself.

For the metric party has been overwhelmed. Their supposed facts have been shown to be nothing but the figments of the imagination and every argument of theirs has been shown to be hopelessly unsound. In the words of a speaker at the recent British Textile Congress, "So far from the system having conquered the world, it does not appear to have been victorious in any part of it."

I send you herewith copy of a recent lecture of mine entitled "The Metric Fallacy," and delivered at Cornell University. While an hour is a brief space into which to compress a discussion of such a subject, the lecture will, I think, enable you to judge of the strength of the anti-metric case. F. A. HALSEY.

*These letters should have appeared last issue, but owing to lack of space were left over.

ENGINEERING NEWS
AND BUSINESS NOTES

STEAM ENGINEERS' CONVENTION.

WITHIN the past month the ninth annual convention of the International Union of Steam Engineers of America was held in the Labor Temple, Toronto, and its proceedings were marked by the utmost interest on the part of the 200 delegates, many of them accompanied by their wives, who were present. One of the main topics of discussion was the question of an eight hour day, which the steam engineers have been advocating with considerable success for some time past. The reports showed that the growth of the union has been healthy and of a permanent character. Another feature which was noticeable is the freedom from strikes and lockouts enjoyed by this union. Charters had been issued in the past year for 31 new local unions. Mr. J. E. Bruner, of Cincinnati, the president, occupied the chair during the meetings. After considerable voting it was decided to hold the next convention in Milwaukee. The new officers elected are:

M. Comerford, general president.
A. McCracken, 1st vice-president.
J. Bannon, 2nd vice-president.
A. Huddell, 3rd vice-president.
A. J. Skiffington, 4th vice-president.
J. W. Wood, 5th vice-president.
S. Jones, chairman trustees.
J. Sherriffs, trustee.
G. Allen, trustee.

Herewith is given an illustration, showing a view of the exhibitors, representing the different companies who had prepared neat and attractive exhibits, and who were in attendance at them during the exhibition.

The Canadian Fairbanks Co., Limited, had an excellent exhibit of valves, steam gauges, steam traps, steam whistles, injectors, and other steam specialties. The valves were artistically displayed on a vertical cloth-covered board. D. T. White and T. B. Reid had charge of the exhibit.

Green, Tweed & Co., New York, makers of the Palmetto packing, for which the Canadian Fairbanks Co. are sole Canadian agents, were represented by H. S. Demarest, manager, and B. N. Ham.

A fine exhibit of steam specialties was that made by the Lunkenheimer Co., Cincinnati. Those in charge of the exhibit were Wm. Schmidt, Jr., and John T. Carlind, Canadian salesman.

Babcock & Wilcox had on exhibit some of their steel forgings, and they distributed some of their literature, including a catalogue entitled "How to Choose a Water Tube Boiler." A. C. Larkin, manager of Toronto branch, was in charge.

The steel tape souvenir, distributed by the New York Belting & Packing Co., Limited, 25 Park Place, New York, was much appreciated by the delegates. L. L. Taylor, manager of the packing department, was at the convention in the interests of the firm.

John H. Foote had charge of the exhibit of McLeod & Henry Co., Troy, N.Y., which consisted of "Steel Mixture" boiler setting, including a model boiler and setting.

The Rainbow-Peerless Rubber Mfg. Co., 16 Warren street, New York, had an excellent exhibit of their rubber goods, including rubber belting, tubing, packing, etc.

Jordan Bros., 74 Beckman street, New York, exhibited one of their Jordan Commutator Truing Devices, the firm being represented by Dan. McDermid.

The exhibit of the Economical Supply Co., Queen street east, Toronto, included their new lubricating graphite, described in "Power and Transmission" department of this issue, besides magnetic belt dressing. H. L. Brown, manager, had charge, while H. C. Holland and Wm. Bonland, sales agents, were associated with him.

The Norwall Mfg. Co., Union Building, Chicago, was represented by S. S. Brewer, who was very enthusiastic in demonstrating the features of the Norwall automatic air valves and packless radiator valves.

Jenkins Bros., New York, had a fine exhibit of their valves, of all kinds, gasket tubing, etc. They also distributed literature including their general catalogue and bulletin on "Valve Troubles and How to Avoid Them."

The Garlock Packing Co. exhibited a showcase of all kinds of packing, besides distributing catalogues and other literature.

Space prevents further details of the exhibits. Amongst other exhibitors should be mentioned the Canadian Steam Boiler Equipment Co., Toronto, the Crandall Packing Co., Palmyra, N.Y., the United States Graphite Co., Saginaw, Mich., the Dearborn Drug and Chemical Works, New York, the John McDougall Caledonian Iron Works Co., Limited, Montreal, the International Correspondence Schools and the Lagonda Manufacturing Co., Springfield, O.

Exhibitors at International Convention of Steam Engineers.

To Change Mining Laws.

With a view of aiding the Government to submit at the next session of the Legislature a proper revision of the mining laws, mining men are being asked by the Crown Lands Agents in the various districts to hold local meetings and to place themselves on record as to what changes in the laws they think desirable. They will be asked also to select delegates if they see fit, who may meet in general convention, to be held at Parliament Buildings about middle of November, to discuss the resolutions adopted by the local meetings. The mining centres where local meetings are likely to be held are: Kingston, Madoc, Haileybury, Sudbury, Sault Ste. Marie, Port Arthur, Kenora and Fort Frances.

Practical Questions and Answers

Applying Motor to Machine Tool.

Ques.—What are the considerations to be taken into account when equipping a machine tool with a variable speed D. C. motor direct connected through gearing, chain, or belt ?

Ans.—The application of individual drive would require a somewhat different consideration for each machine tool, although in the main it would be the same. As a good example the application of a variable speed D. C. motor, multi-voltage control, to an engine lathe will be here considered. It is desirable to get as much work out of a lathe as the tool steel and the lathe itself will stand, and thus the first thing to be determined is the speed range that can be obtained at the spindle as the lathe stands, and then the new range of speeds desired. The new range of speeds will depend upon the work to be done, upon the tool steel used, and upon the strength of the lathe. What the tool will stand on certain materials and with certain tool steel and spindle speed is best determined by actual test. The minimum speed would be for the heaviest cut of the largest diameter of work, while the maximum speed will be the lightest cut, or for filing, on the smallest diameter of work.

Having determined the speeds, the next thing required is the horse-power, and this depends almost directly upon the amount of metal removed. A much used formula for this purpose is :

H.P. = feed × cutting speed in inches per min. × number of cutting tools × a constant.

This constant varies, of course, with material. An extensive series of tests made by the Crocker-Wheeler Co. show the value of this constant to be from 0.35 to 0.5 for cast iron, and from 0.45 to 0.7 for steel, depending upon the hardness of each metal. Perhaps for a good safety factor it would be well to assume these constants somewhat higher than here given, and then should an extra hard piece of metal be struck it would be assured that motor was not running under too great an overload.

A good example of the application of a variable speed D. C. motor, multi-voltage control. is had in the machine shop of the Pittsburg & Lake Erie Railway. Recently the entire tool equipment of this shop was changed from mechanical to electrical drive under the supervision of their mechanical engineer, R. V. Wright. The application of a motor to a 20-inch Reid lathe, as installed by Mr. Wright, will be here taken as a concrete example.

The intermediate speeds between any two voltages were obtained by changing the resistance in the armature of the motor, and the controller used as a Crocker-Wheeler M.A. 12. The range of speeds of from 8 to 240 revolutions per minute were required upon this tool. The class of work to be done being heavy, it was decided to fit it up with a capacity of a $\frac{1}{4}$ inch cut with a 1-32 inch feed on hard steel at a cutting speed of 50 feet per minute. The horse-power required to do this work = 1-32 × ¼ × 50 × 12 × 1 × 0.7 = 3.28 horse-power, according to the formula and the steel constant given above. The back gear ratio was 10.1 to 1 in the lathe as it stood. The engineer considered and solved the problem in the following manner, as described by himself :

Assume the motor to be connected so as to drive the main spindle at 240 revolutions per minute. Now, if the back gear is thrown in, the spindle speed will be 240 ÷ 10.7 = 22.4 revolutions per minute. In order to fill in the gap between 25 and 240 revolutions per minute the motor would be required to have a speed range of about 9.6 to 1. It would be found that when the motor is running at 1-9.6 of its maximum speed, the lowest speed, it will furnish about 20 per cent. of its rated power. Therefore, in order to furnish 3 horse-power throughout the range, a 15 horse-power motor would be required. A motor of that size would be bulky for a 20-inch lathe, nor would it be efficient at the lower speeds.

It was then considered whether with the required power and speed range a smaller motor might not be used by changing the number of teeth in the gears. Two hundred and forty to eight revolutions per minute is a range of 30 to 1. For such a range the motor and the run of gearing would each have to cover a range of speed of about 5.5 to 1. It will be found that the motor when running at 1-5.5 of its maximum speed furnishes practically the same per cent. of power as in the case considered above. The advisability of adding another run of gears was considered. The motor and each run of gears would then be required to have a range equal to the cube root of 30, or about 3.108 to 1. The spindle speeds would run thus :

	Maximum.	Minimum.
First run	240	77.3
Second run	77.3	24.9
Third run	24.9	8.0

It would be just as well, however, if there were a jump of speed between the different runs of gearing equal to the 10 per cent. speed increments furnished by the controller. Reduce the speed range of the motor 10 per cent., or from 3.108 to 1 down to 2.79 to 1, and the spindle speeds will run thus :

	Maximum.	Minimum.
First run	240	86
Second run	77.3	27.8
Third run	24.9	8.93

The lower speed limit is increased somewhat, but this can easily be remedied by changing the ratios slightly. The motor could, of course, be run at a still lower speed, but at reduced power.

It will be found that when the motor is running at 1-2.79 of its maximum speed it furnishes 60 per cent. of its power. Therefore, in order to have a three horse-power available throughout the range a five horse-power motor will have to be used. At controller point 10, 11 and 12, it will run a little below three horse-power, but the motor will run at full power at these points a small part of the time only, and it can easily take care of the slight overrun.

* * *

Starting a Steam Turbine.

Ques. If a large steam turbine is cold and at rest, how quickly can it be started? Can it be brought up to speed as readily as can a good cross compound engine that is cold all over?

Ans. This subject was dealt with in considerable detail by A. S. Mann in a paper read before the American Society of Mechanical Engineers in June. In a power house known to him steam turbines are started in a time which will be surprising to most engineers. The units are three Curtis turbine-driven alternators, each of 1,500 k.w. capacity, and are used as an auxiliary to a water-power plant. Slow fires are kept in the boilers all the time, and at the signal for more power a blower is started on the boilers, all blast dampers are opened and the stokers are allowed to feed at maximum rate. Simultaneously the pump for the step bearing, the exciter, the circulating pump, the hot well pump and the air pump are started and then the turbine. As soon as the machine approaches speed, the synchronising system is cut in and the main switches are got ready. This requires one and one-half minutes, including the time required in mustering the crew. The phasing-in requires one minute, and thus the whole thing is done in two and one-half minutes.

A cross-compound reciprocating engine, of the four-valve type, 2,250 h.p. capacity, can be brought up to speed in five minutes if it is hot all over. If the engine is cold all over, has its oil cups tight shut and all its auxiliaries quiet, fifteen minutes is called a rapid start.

Power and Transmission

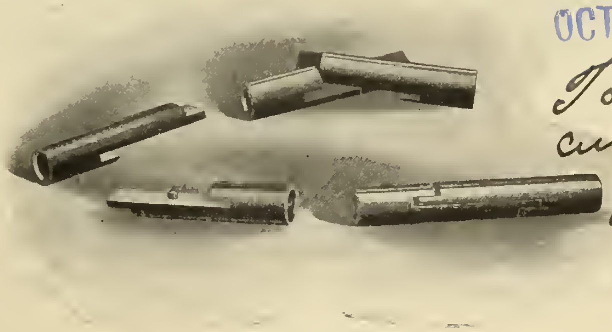
Steam Gas Electricity Compressed Air Water

C. C. L. INDUCTION MOTORS.

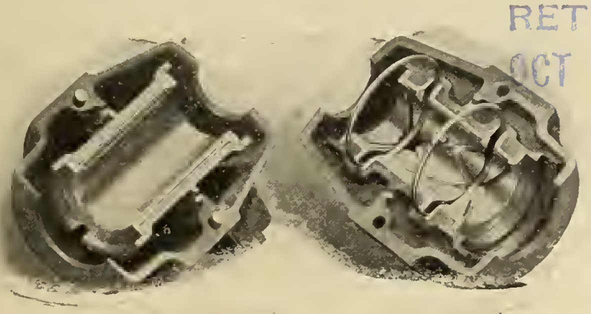
HEREWITH are given some illustrations of a new type of solid frame polyphase induction motor manufactured by the Canadian Westinghouse Co., Limited. It is not long since very few motors were used in connection with industrial plants but with larger factories and present day methods the older forms of power transmission are being superseded, the re-action being in favor of the electric motor.

The CCL induction motor consists of two parts, a stationary primary and a rotating secondary. The rotating element is carried by two bearings supported by end brackets which are bolted to a solid cast-iron frame. The line circuit is connected to the stationary winding, and the rotor being of the squirrel cage type, no sliding contacts are employed. The only wearing parts of the machine are the bearings, and as these are of ample dimensions with a light revolving element and excellent oiling facilities, the wear is exceedingly slight. Such a motor may be placed in any convenient location without regard to its accessibility, as the only requirement for its satisfactory operation is that the oil reservoirs be kept filled, an attention required by the simplest shafting. Not only does it give entire satisfaction in service, but what is even more essential, it will always operate. The importance of this feature of reliability cannot be too strongly emphasized, for a shut-down even for a short time often causes great annoyance and expense.

The frame is well-ribbed, solid, circular frame with supporting feet carries the laminations of the stationary part and is closed by substantial brackets which support the bearings. This rigidity of construction insures a perfect alignment of bearings under operation and is a mechanical feature of great advantage. Motors below 7½-h.p. have solid brackets and bearings, while the sizes from and including the 7½-h.p. have the brackets and bearings divided in two parts, greatly facilitating the removal of the revolving element when this becomes necessary. The large size motors are provided with bed-plates and belt tighteners, while those under 7½-h.p. have slotted holes in the feet which permit of belt adjustment without a belt tightener. The end brackets may be bolted to the frame in any one of four different positions, so that the oil chambers in the brackets will be in the proper position whether the frame is bolted to the floor, to the wall or to the ceiling.



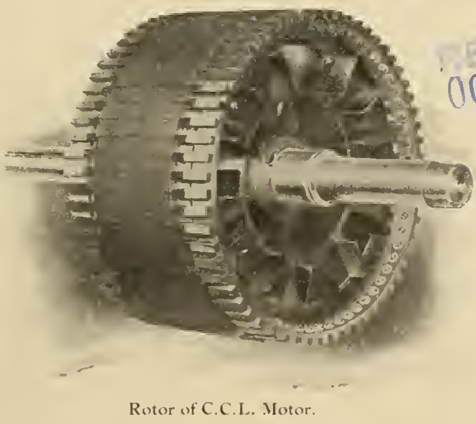
Connectors.



Bearing Housing Open, Showing Bearing.

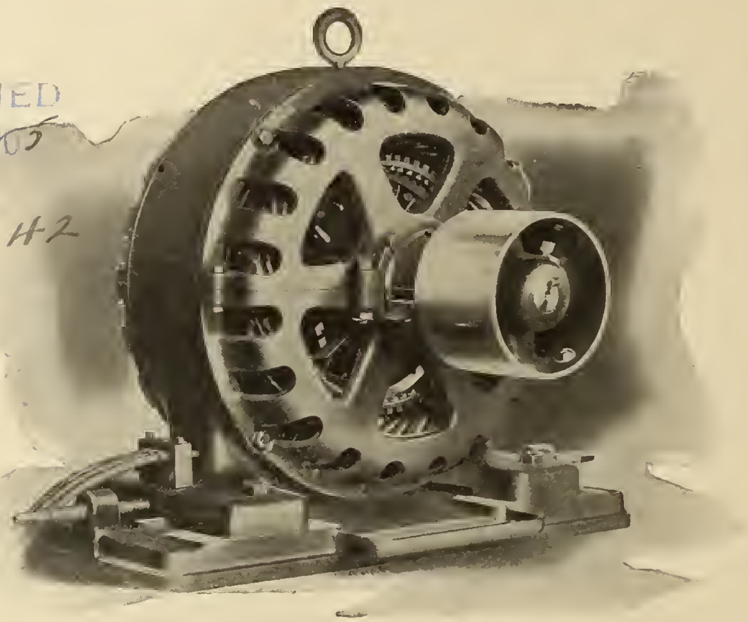
The laminations forming the stator core are mounted in the hollow cylindrical cast-iron frame. The cores of the machines are built up of continuous rings of steel punchings. Leads for connection to the supply circuit are brought out through terminal cleats on the foot of the frame. Hand connectors, such as shown in the illustration printed herewith, are supplied on the terminals of every motor. The core of the secondary or rotor is built up of high grade steel punchings mounted on a cast-iron spider which is keyed to the shaft.

The windings consist of insulated copper bars lying in partially closed slots around the periphery. The conductors are connected together at each end by a



Rotor of C.C.L. Motor.

copper or brass ring of large cross-section to which each is securely attached. This construction is known as a "squirrel cage" winding. The same general form of construction is used for type



Canadian Westinghouse CCL Motor.

CCL motors of all capacities, being extremely simple, rigid and durable.

The design and principles governing the construction of type CCL motors are particularly favorable to maintaining good efficiencies at low loads, which insure a high all-day efficiency, as in general service motors operate at light loads much of the time.

The variation in speed between no load and full load is very small, a characteristic of great value in many instances.

A UNIQUE OBSERVATION CAR.

THE Montreal Street Railway management recently placed in service an observation car that is regarded as unique in street car construction. This type, evolved after the consideration of many plans, originated with Mr. W. G. Ross, the managing director, and Mr. Duncan McDonald, manager of the company.

The observation cars employed in previous seasons were the ordinary passenger cars, and it was often found to be impossible for the tourists to see the places which the guide pointed out, the roof completely obstructing the view.

The new type of car is completely open, so that a general view can be obtained from all sides, while the seats are arranged with a gradual ascent from front to back, similar to the arrangement of the seats in a theatre or a church, so that each is slightly higher than the one in front. Over the car is an arch of electric lights which, at night, produce a charming effect, while electric devices also depend from the sides of the car. The whole effect is attractive, and the design appears to meet the need of tourists and special parties for whom the car has been designed. It was employed all the past Summer for conventions, notably that of the Canadian Press Association and the electrical engineers, and others.

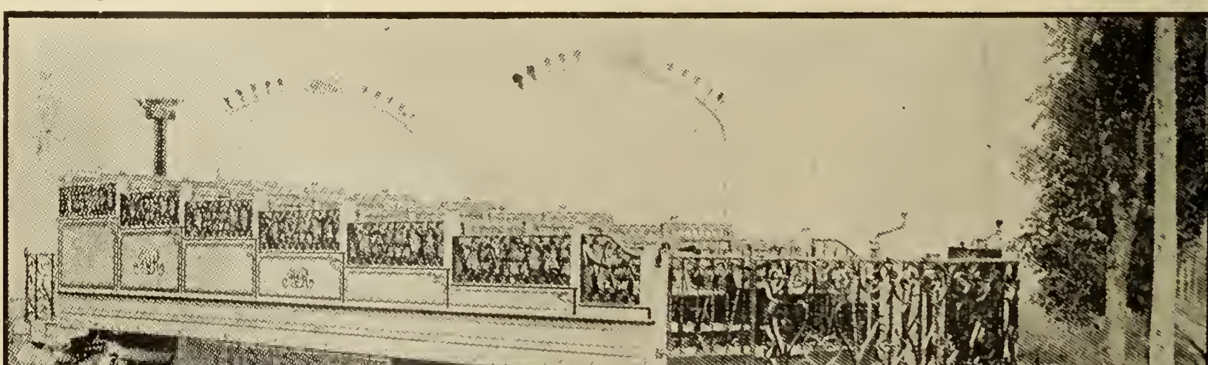
From an inventive standpoint it is peculiarly creditable to Montreal brains that the company have received overtures from all over the United States and Europe asking particulars about the car. Applications have been made to have the car patented everywhere.

The manufacture of the car has attracted some attention, as there are no others just the same, and the management of the Montreal company claim a pardonable pride in the creation which has become the talk of two continents. Further details of the car show that it is handsomely finished with gilt and fine accessories, which go to accentuate the general beauty of it. There is a generous, luxurious appearance about the car that convinces, and during the last two months it has been employed in one of the most beautiful drives to be had anywhere, namely, around the mountain circuit. Crowds have taken advantage of the pleasure vehicle, and it certainly has proven a strong drawing card for the company.

At any rate, from a purely mechanical point of view, the whole credit of the creation is due to the two gentlemen mentioned, Messrs. Ross and McDonald.

EAST TORONTO POWER HOUSE.

THE accompanying illustration shows the interior of the engine room of the electric lighting plant of the corporation of East Toronto. The engine is a single cylinder Goldie "Corliss" engine, manufactured by the Goldie & McCulloch Co., Limited. The cylinder is 17 in. diameter



Unique Observation Car, Montreal Street Railway.

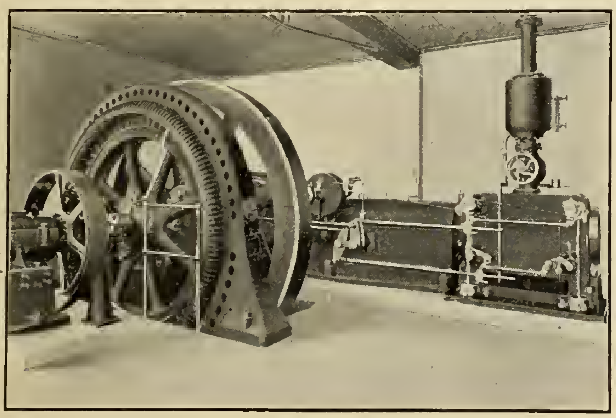
by 30 in. stroke, and the speed is 120 revolutions per minute. The engine runs non-condensing. The steam pressure at the boilers is 120 lbs. This engine is direct connected to a 150 k.w. 60 cycle alternating current generator made by the Allis-Chalmers-Bullock Co., which provides power for the arc and incandescent lighting of the corporation, and also for the municipal pumping station, in which are centrifugal pumps direct-driven by induction motors.

IMPROVED OIL PUMP.

THE Lunkenheimer Co., of Cincinnati, Ohio, are the manufacturers of the pump illustrated herewith, which they have given the trade name of "Marvel."

As will be seen, the driving mechanism is of the ratchet type, operated by the clutches that work co-operatively by the motion of the rod, which can be attached to the eccentric rod, or other moving parts of the engine by the couplings shown. The motion thus obtained is transmitted to the piston by the crank pin mechanism seen on rear view of illustration. The ratchet wheel is provided with a handle whereby it can be rotated by hand in case it is desirable to force a quantity of oil at any time, as for example, in starting the engine. The couplings on rod may be moved up or down, thus lengthening or shortening the stroke of the pump, and regulating the amount of oil fed by the pump, independent of the feed from the oil cup. Joints of the cup are tight, the sight feed glass being packed so as to prevent access of air that would have a tendency to cause the cup to feed after the engine had ceased running. This feature and use of check valves in the pump prevent wastage of oil supply. The feeding of oil is automatic, i.e., starting and stopping with the engine. The outlet is connected to the steam pipe or engine valve chest, and a spring check valve, supplied with the pump, should be placed in this connection as near as possible to the point of entry into the steam pipe or chest. The bottom of the pump body is tapped $\frac{5}{8}$ in. bolt thread to receive a stand, so that it can be placed wherever desired. All parts are made to jigs and templets, and are therefore easily renewed and interchangeable. The ratchet wheel, pawls, shaft, and yoke are made of tool steel, tempered and hardened. All other metal parts about the pump are made of the very best bronze composition.

The filling hole is of large area, so as to fill easily; the cup is also fitted with a strainer and hinge cap, which cannot be lost. This pump is also made with double-feed, and for traction engines, or where a heavy oil is to be fed, the pump is supplied with a compression oil cup, the oil being forced to the pump by means of a spring actuated plunger in the cup. Where pressure systems have been installed, the pump is equipped with a Lunkenheimer "Reserve" pressure oil cup, a combination giving perfect satisfaction wherever used.



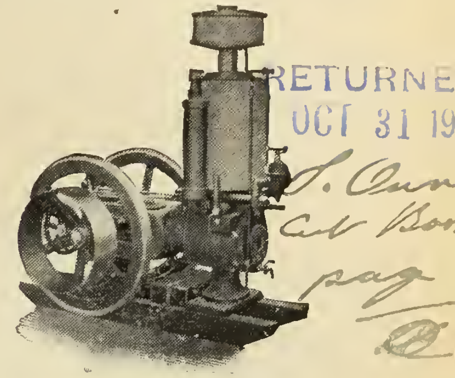
A Recent Installation in East Toronto Power House.

THE STICKNEY LINE OF ENGINES.

THE accompanying illustration is of a line of engines manufactured by Charles A. Stickney Co., St. Paul, Minn., for power purposes. Although this engine is in general of the standard type of four cycle engine, it has several features which are worthy of attention.

The electric igniter is placed outside the cylinder, and can be taken apart for the examination of the sparking device and replaced without much trouble and in a very short time. The spark coil is contained in a cast iron waterproof case with switch attached. The current is furnished by a set of waterproof batteries. The mixer is a patented device and is claimed to give the cylinder a correct proportion and thoroughly mixed charge of gasoline and air under all conditions of speed and weather. The air admitted to the mixer can be varied in temperature to suit the weather conditions by an air heater situated about the exhaust pipe, together with a regulating valve.

On engines larger than three horse-power the speed is regulated by the governor holding the exhaust valve open and inlet valve closed, while it also oper-



Stickney Gas Engine.

ates a patented device which prevents the igniter from operating. This system of speed regulation tends to increase the life of the batteries and of the igniter, should the engine be running on light loads, besides saving gasoline.

The water tank, as can be seen from the illustration, is bolted directly to the cylinder, and there acts as a kettle of water on a stove, that is, as the cylinder of the engine becomes heated the water absorbs the heat until a temperature of 212 F. is reached, after which the heat units are used up in converting the water into steam, and the temperature remains constant till the water is boiled away. This system has a decided advantage in freezing weather, since it requires a minimum amount of water to be drained off to prevent freezing.

The cylinder, cylinder head and valve box are all cast in one piece.

The company guarantee that all engines are tested before leaving the factory, and that in the test they have developed their rated horse-power.

Continuous Oiling System.

The Ontario Wind Engine & Pump Co., Limited, Toronto, are sole Canadian agents for these engines.

PILLING AIR DRIVEN MACHINERY.

SOME new applications of the air engine made by the Pilling Air Engine Company, Detroit, Mich., are shown in the accompanying engravings. Figure 1 gives a view of a $2\frac{1}{2}$ by $2\frac{1}{2}$-inch engine direct connected to a $1\frac{1}{2}$-inch centrifugal pump having a normal capacity of 60 gallons of water per minute. In actual tests the pump has thrown 69 gallons in half that time, or 30 seconds. The engine runs in oil and attains a speed of 1,800 revolutions per minute when supplied with air at a pressure of 75 pounds per square inch. A set of the type illustrated has been in use for two years in one of the Baltimore & Ohio Railroad Company's roundhouses. The engine and pump are located at a distance of 3,000 feet from the point where the water is used and are controlled from the latter point.

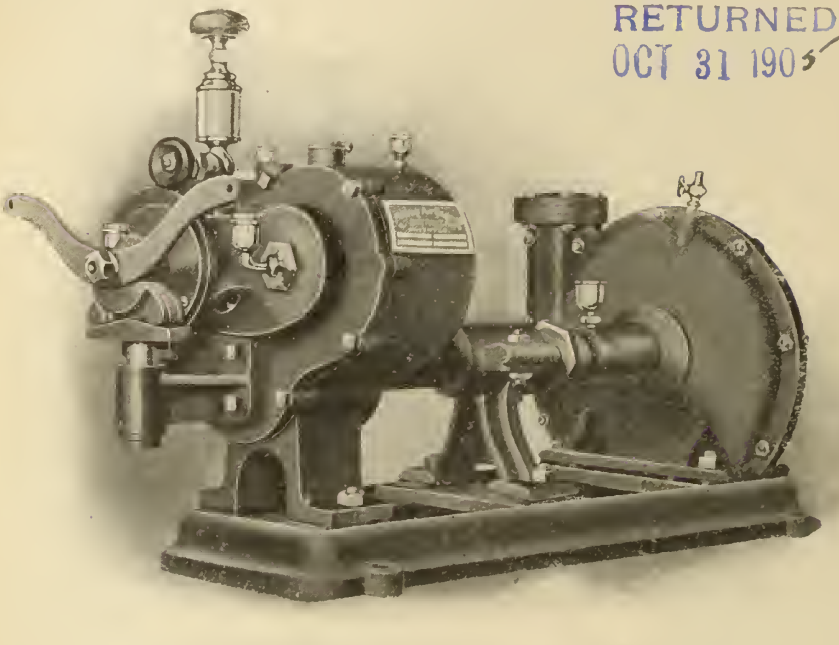


Fig. 1.—A $2\frac{1}{2}$" $2\frac{1}{2}$" Pilling Air Engine Direct Connected to a $1\frac{1}{2}$" Centrifugal Pump.

An engine of the same size is shown in Figure 2 geared with two reductions to a hoisting drum. The set is one particularly adapted to the elevating of coke and pig iron to cupolas, being used either to haul a car up an incline or lift it vertically. The hoist is also a convenient one for use in building construction for raising beams, timber, mortar, etc. When used to hoist from above instead of from below the friction of a leading block is avoided. The engine is provided with an automatic stop by means of which the travel is limited at will, the engine being stopped instantly when running either in the hoisting or the lowering direction. The self-contained set illustrated weighs about 380 pounds and can be arranged to operate from above or below.

Figure 3 shows a special piece of apparatus designed for the Niles Tool Works, Hamilton, Ohio, for reciprocating the heavy surfacing saddles and cross rails of large planers. The saddles referred to weigh up to 2,000 pounds and through the agency of this device may easily be manipulated by a boy.

A NEW LUBRICATING GRAPHITE.

THE Economical Supply Co., 173 Queen street east, Toronto, are putting on the market a new form of graphite for lubricating purposes, which they call "Canada Graphite." The purpose of a graphite in lubricating is to fill up all unevenness of the surfaces in contact, to do which it is required that the graphite be fine and have adhesive powers. This new graphite is an impalpable "air floated" powder, which has remarkable adhesive qualities. The graphite mixes readily with oil, and thus can be used dry or in combination with oil, allowing a much thinner and cheaper oil to be used.

This graphite also has a field as a joint and gasket compound.

WHO MAKES GAS ENGINES?

A SUBSCRIBER requests the names of the firms in Canada who manufacture gas, oil or gasoline engines either entirely or in part. Our list includes a large number, but it is quite likely that there are others, and any manufacturer who should be and is not included would confer a favor by making us cognizant of the fact at an early date. The names are: Canadian Fairbanks Morse, Limited, Toronto; Tuerk Iron Works, Berlin; Goold, Shapley & Muir Co., Limited, Brantford; Defiance Iron Works, Chatham; D. McKenzie & Co., London; Hamilton Motor Works, Hamilton; Reid Gasoline Engine Co., Hamilton; Stratford Mill Bldg., Stratford; Sylvester Mfg. Co., Lindsay; Acme Mfg. Co., Toronto; Georgian Bay Engineering Works, Midland; Waterous Engine Works Co., Limited, Brantford; Canadian Automobile Car Co., Berlin; J. B. Hall, Toronto; Edwin Housey, Toronto; McLauchlan Gas & Gasoline Engine Co., Limited, Swansea; Commercial Acetylene Co., of New York, Toronto.

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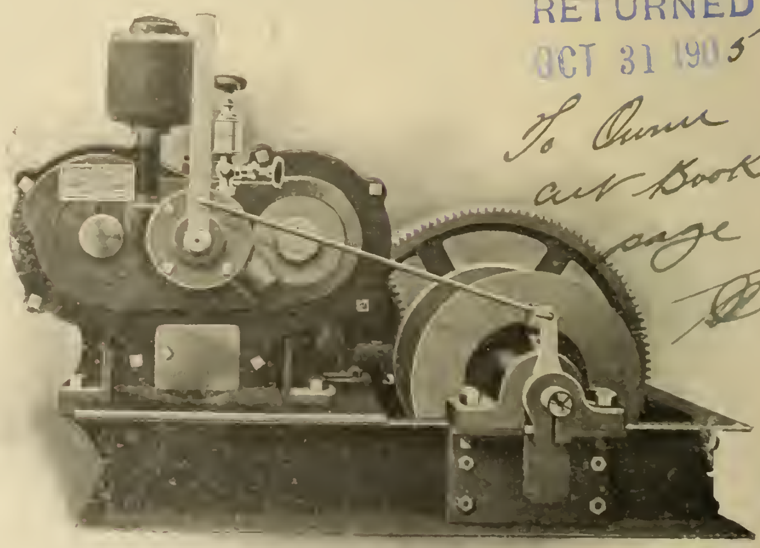


Fig. 2 A Drum Hoist Gear, Driven by a $2\frac{1}{2}$" x $2\frac{1}{2}$ Pilling Air Engine.

The Case Threshing Machine Co., Racine, Wis., are planning to erect a mammoth factory at Winnipeg, in order to supply the Canadian trade. A site has already been secured on the shores of Lake Winnipeg.

ABOUT CATALOGUES

By mentioning Canadian Machinery, to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Hack Saws. The West Haven Mfg. Co., New Haven, Conn., are sending out a catalogue, 6 x 9 inches, descriptive of their product, the most space being occupied in describing and illustrating their Globe and Universal power hack saws. Other manufactures taken up are hand hack saws and plumbers' hollow mill saws.

Little Jap Hammer Drill. The Ingersoll-Sergeant Drill Co., 26 Cortlandt street, New York, are sending out Bulletin No. 2001, descriptive of compressed air tools. It is well illustrated, and contains 19 pages, 6 x 9 inches.

Reversing Controllers. Circular No. 1108 of the Canadian Westinghouse Co., Limited, Hamilton, Ont., illustrates and describes the Westinghouse regulating and reversing controllers. It is a 23-page circular, fully illustrated.

Small Springs—The Wallace Barnes Co., Bristol, Conn., are sending out a neat booklet dealing with small springs of every description.

Sterling. Catalogue No. 12 describes hack saw blades and frames, power machines, kitchen saws, etc., manufactured by the Diamond Saw & Stamping Works, Buffalo, N.Y. It is fully illustrated and contains data regarding size, cost, etc., of the different lines. It contains 15 pages, 5 1-4 x 7 3-4.

Canadian Bearings, Limited. A circular devoted to the merits of the Wright roller bearing, recently invented and now being manufactured by Canadian Bearings, Limited, information regarding the company being formed, as well as some of the mechanical and technical features of the bearing are discussed.

An Electrified Railway Shop. Bulletin No. 58, issued by Crocker Wheeler Co. Ampere, N. J., succintly describes an electrified railway shop, written by its mechanical engineer. It contains sketches and illustrations and considerable information on this subject, in which the Crocker Wheeler motors play an important part. Other bulletins recently issued by them are No. 55, describing small generators arranged for direct connection, and No. 56, generating sets with case engines, No. 57, generating sets with Forbes engines, No. 59, engine type alternating current generator, No. 60 small motors, the latter containing some splendid illustrations of the recent adoption of small motors for almost every class of work.

Canada Foundry Co., Limited. Bulletin No. 31, describing their rock and ore crusher, besides an illustration a section view of which is given and complete details regarding construction and capacity are included.

BOOK REVIEWS

The Copper Hand Book (volume V.) A manual of the copper industry of the world for the year 1904, compiled and published by Horace J. Stevens, Houghton, Mich. Price, $5.00.

Anyone at all interested in copper or the copper industry must take up this book with a feeling of satisfaction, since it contains such exhaustive and valuable information upon the copper industries of the world. It contains 882 pages divided into sixteen chapters devoted to the history, uses, geology, geography, chemistry, minerology, finances and statistics of copper. The major part of the book is occupied by a chapter devoted to detailed description of the copper mines of the world, 3,389 in number. These descriptions range from two lines to twelve pages, each according to the importance of the property. From a purely local circulation, with its first issue five years ago, this publication has come to be a standard reference book for the world along the line of copper industry.

Engineering Turning. A hand-book for working engineers, technical students and amateurs, by Joseph Horner, A.M.I.M.E.; London, Crosby, Lockwood & Son, publishers; 404 pages, 488 illsutrations; price, $2.50.

This book takes up the principles and practice of turning as embodied in present day methods in large shops. These features of turning are considered and well illustrated, while the subject of chucks and special methods adopted is given considerable attention. Modern turret practice takes up a chapter containing much useful information on this important feature. The author deals with the subject in a simple descriptive manner, so fully illustrating the subject matter as to render it very clear and easily understood.

Design of Structures. An application of graphic and other methods to the design of structures, especially prepared for the use of engineers by William W. F. Pullen; Manchester, the Technical Publishing Co., Limited: second edition; 341 pages; illustrated with diagram; price, 5s. net.

Throughout this book the author makes it prominent that graphic methods are only the instruments by which particular numerical results are often easily obtained, and if considered apart from phyiscal conditions and quantities they are simply mathematical exercises and of little real use to the engineer or the engineering student. At the commencement the graphic solution of equations is treated to some extent, followed by a chapter on the law of equilibrium. From this shearing force and bending moment are described which introduces the graphical determination of bending moment and reactions. From the simple members used in construction, the student is led on to more difficult features, dealing with roof trusses, ventilators, bracing, bridge trusses, masonry structure, etc. Any student of engineering taking up the theory of structures would be in a position to appreciate this book as well as any practising engineer, who would find it useful for reference.

The Cost of Production. The principles of the science of costs with illustrative examples by cost experts for various lines of manufacturing industry, collected and edited by B. C. Bean, M.E., LL.D.; enlarged edition containing 198 pages; Chicago and New York, The System Co.

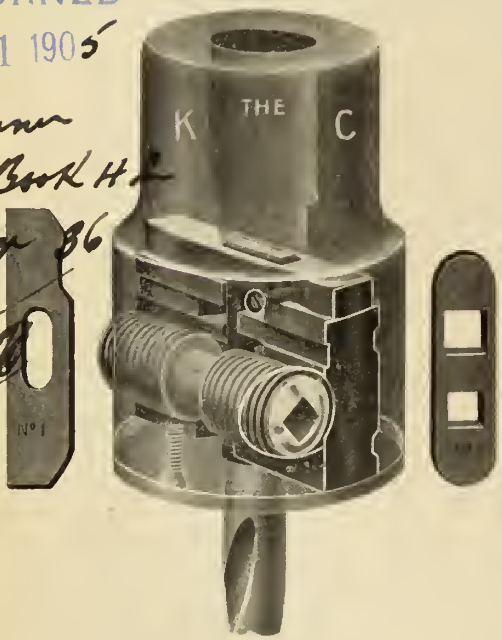
The question of the cost of production has been taken up from a broad standpoint applicable to any business in such a way as to be not only simple enough to be followed by any manufacturing company, but at the same time to contain information of value to the experienced cost expert. In part I. the science of costs is taken up beginning with the utility of a cost system. The development of the science of costs leads up to the question of selling price, followed by chapters on material, labor, burden, indirect labor, depreciation, selling expenses and cost. In part II. are chapters on illustrative cost keeping, covering cost of systems for a factory, factory costs, cost of wood working, ascertaining the cost of production, how factory costs are found, ending with a chapter on the cost of production.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

NEW DRILL CHUCK.

KRUG & CROSBY of Hamilton, Ont., are placing on the Canadian market a new drill chuck of superior merit. The illustration shows the drill in chuck with flattened end of drill in hardened cast steel plate No. 1 in place. This plate is removable by simply inserting end of chuck wrench and a slight pressure releases the spring plunger which locates slot in plate centre with centre of chuck body. No. 2 plate can then be inserted, which plate is suitable for driving taps, reamers, etc. Slot in No. 1 plate is 3-16 inch wide by 17-32 long and will drive ¼ by ⅜ inch taps. No. 2 plate drives 5-16, 7-16



Krug & Crosby Drill Chuck.

and ½-inch taps, making a positive driving chuck which does not chew the shanks of drills and cut the chuck jaws to pieces. Taper shank drills can be used without sleeve or any other device and drive accurately in same, also for shanks of wood bits, and drills may be ordered with flattened ends from the makers of same without extra charge, but a few minutes on an emery wheel will suffice to flatten all drills within its capacity. Drills need not be ground very accurately as the plate adjusts itself to the alignment of the jaws, thereby insuring accuracy. A chuck sent on trial to responsible parties. Accuracy, interchangability of every part, strongest style of screw known, and all parts hardened that are subject to wear, are the standards we have adopted and any chuck purchased is fully guaranteed to be as represented. Prices lower than the unimproved chucks, as this is the only drill chuck "made in Canada," and the quality is the best. Chucks can be ordered with plates or without. Further particulars may be had by applying to the above mentioned firm.

THE FACTORY GUARDIAN.

RECOGNITION of the advantage of having an alert watchman on guard during the dark hours of night is being more and more generally accepted by manufacturers throughout Canada, the influence of insurance companies doing much to that end.

To secure alertness on the part of the watchman is probably the most important essential in this connection, for if the guardian of the premises is inclined to take a quiet snooze once in a while his value is decreased by half. The old style carry around watches are easily manipulated by a tricky watchman, therefore the installation of a system of electric clocks throughout the premises has become the habit among larger manufacturing plants in this country.

The Eco Magneto Clock Co., of Boston, have made a scientific study of this problem and their years of study have evolved a clock system that seems to fill every requirement. It is operated by a magneto battery so it can be guaranteed not to get out of order and cannot be interfered with.

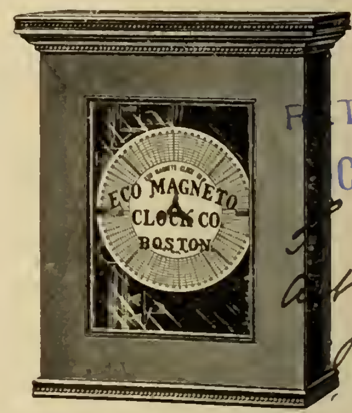
The company has installed their Eco Magneto Clock in many of the largest and most up-to-date plants in Canada, including the Cox Foundry Co., General Electric Co., Huntsville and Bracebridge tanneries and John Penman's mills at Paris, Port Dover, etc.

Amongst recent equipments is the W. J. Gage Co., A. E. Rae Co., Merchant Union Co., P. M. McIntosh & Son, the Welland Sanatorium at St. Catharines, Grafton & Co., Dundas; Canadian Drawn Steel Co., B. Greening Wire Works, Frost Wire Fence Co., Sawyer-Massey Co., of Hamilton; W. M. Lowney's new chocolate factory, Montreal; Wiser's distillery, Prescott; Canada Carriage Co., Brockville Lumber Co., and Wolthansen Hat Corporation of Brockville, etc., etc.

ECONOMICAL LUBRICATION.

LARGEST of all items on the supply account of any power plant is the oil bill. It is usually exceeded only by the costs of fuel and wages, even the repair bills in a well-kept modern plant aggregating ordinarily less than the costs for lubrication of bearings, cylinders and other rubbing surfaces. Economy af lubricating oils is consequently a matter of no mean importance and becomes of special moment when savings so great as 50 per cent. are possible.

"Cut your oil bills in half." This is an attractive proposition of itself and grows in force when the saving per week, per month or per year is put into actual figures. The attention being given nowadays to this feature of power plant



Eco Magneto Clock.

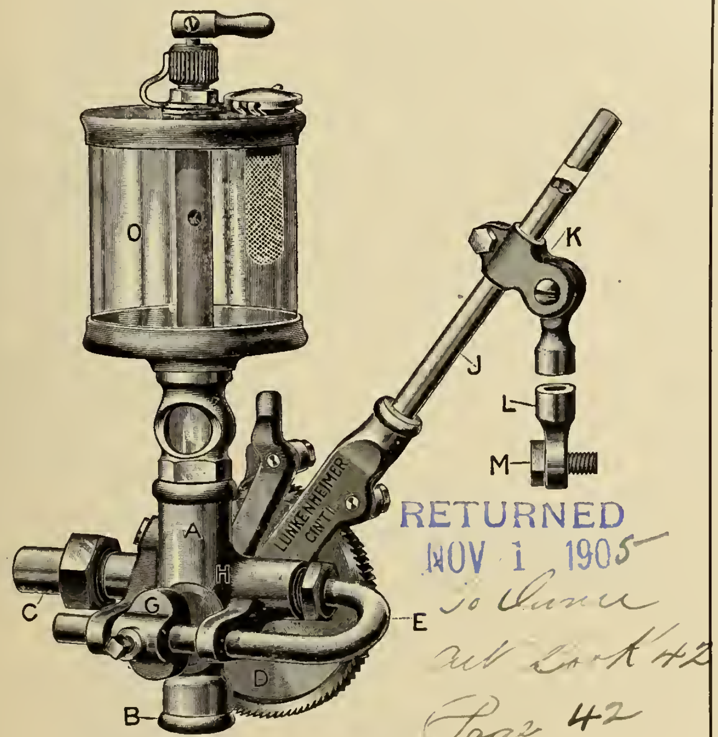
economy is well shown by the careful arrangement of lubrication details in some of our modern installations of largest size. For instance, the Lackawanna Steel Co., of Buffalo, N.Y., is equipping its engine plants for utmost economy of oil usage and handling.

At these mills, the largest steel works in the world, there are installed 48,000-horse-power of engines. Five Allis-Chalmers vertical cross-compound steam engines give 16,000-horse-power for driving roll trains, etc. There are two blowing engine houses, each with eight units driven by 2,000-horse-power Koerting gas engines, built by the DeLavergne Machine Co., New York. The complete power installation of 48,000-horse-power is now being equipped with the "White Star" Continuous Oiling System, manufactured by the Pittsburg Gage & Supply Co., of Pittsburg, Pa.

By this system the oil is distributed continuously to all bearings, keeping them constantly supplied with just the right amount of oil to insure best results. All drips and used oil are drained away to the "White Star" Filter, which constitutes one feature of the system. Passing into the filter, they are there cleaned of all impurities, and then pumped to the elevated storage tank, whence the oil is returned to the circuit. Loss of oil is avoided entirely, the only means of escape from the system being by actual wearing out in the bearings. This, of course, means greatest possible economy.

Consideration of usual conditions will readily show the experienced power user how easily this system may affect saving of at least half the oil, eliminating waste losses and insuring actual use of every drop. About two years ago the power plant of the Union Steel Co., at Donora, Pa., was equipped with the "White Star" system. Previous to this installation, a 38 and 75x60-in. twin tandem-compound condensing engine, Porter-Allen type, required an average of 1,050 gallons of engine oil per month. This has been cut now to an average of 503 gallons under similar conditions—a saving of more than 52 per cent. In this same plant, on two 30 and 60x48-inch engines, the oil consumption was reduced from 400 gallons to 195 per month. As a further item of saving directly credited to the "White Star" system, the services of three oilers required under the old regime were dispensed with from the start. The wages account therefore also shares in the economy.

Bearing upon this subject of Modern Engine Lubrication, the Pittsburg Gage & Supply Co. has some interesting literature which is forwarded to any one interested.



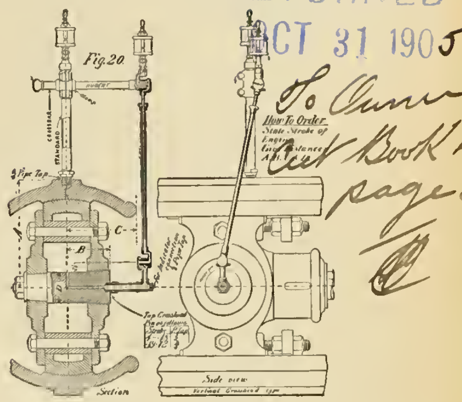
Mechanism for Oil Supply.

NUGENT CROSSHEAD PIN OILER.

THE Nugent Anti-Packed Telescopic Oiler, which is shown in the accompanying illustration, is designed to lubricate any reciprocating bearing such as the crosshead pin, eccentrics, and double disc crank pins of steam engines and other similar bearings.

The anti-packed joint is the new, novel and improved feature of this invention. The joints are 1-100 of an inch loose and yet not a drop of oil can leak or waste through them. They have no stuffing boxes, washers or packing of any kind. Thus the friction, wear and jar is practically done away with, also all unsightly braces or guy rods. This device will outwear the engine or piece of machinery to which it is applied.

This oiling device forms a conduit or channel for the oil from the stationary cup to the bearing which is to be lubricated. It will about treble the life of the crosshead pin, which usually wears out as fast again as the crank pin. It will save its cost in oil in a short time over any other appliance. It enables the engineer to know positively whether or



Crosshead Pin Oiler.

not the bearing is getting oil, and it places the pin or bearing under his absolute control at all times and enables him to run his engine continuously for ten years, if necessary, without having to stop to replenish the oil. By simply pulling out two cotter pins with the fingers, the telescopic tubes and heads may be removed in a moment's time.

The purchaser of this appliance takes no chances whatsoever, for perfect satisfaction is guaranteed and purchase money will be refunded any time within one year from date of purchase if the oiler does not fulfill expectations. Any further information about oiling devices which may be desired will be gladly given by the manufacturers, Wm. W. Nugent & Co., 22-24 W. Randolph street, Chicago.

The same firm manufacture special oiling devices for the crank pin, eccentrics, centre crank engine, lower shoe of the crosshead and loose pulleys. They also issue a valuable treatise on "How to Oil an Engine," which will be sent free to any engineer or owner of an engine requesting it. It contains a lot of good pointers gathered by Mr. Nugent from practical experience while running, erecting and manufacturing engines.

Commutator Truing Device.

COMMUTATOR TRUING DEVICE.

AN illustration is given on this page of a truing device for truing commutators without removing armature manufactured by Jordan Bros., New York. The wheel used on this de-

vice is made of a special composition and contains no emery or other mineral matter and will not injure the insulation between the commutator segments. Full instructions for fastening and operating sent with each device. This apparatus can also be used on all large-sized motors by running motor and making a suitable insulated attachment for fastening same to motor frame or rocker arm. This device is very simple and can be applied to any dynamo or motor for turning commutator, thereby saving labor, expense and delay of removing armature and placing in lathe in order to turn commutator. It also does away with the danger of the diamond-point tools digging into bars of commutator; also dragging copper across insulation between bars, thereby short-circuiting same.

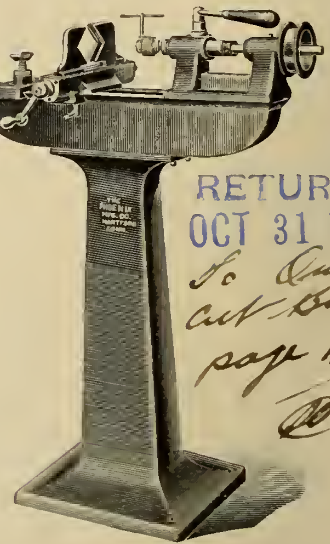
This device can be fastened to rocker arm or any other suitable place on dynamo or motor, being operated by small belt from commutator shell or from armature shaft. There is no other power necessary except that derived from dynamo or motor. This is not an experiment, but has been thoroughly and practically tested and found true in all particulars. Commutators turned by this device will be perfectly smooth and true and the same is especially recommended for Siemen's-Halske dynamos and all dynamos having large diameter commutators on same. The shaft revolves with a brass bushing which has a hardened steel cup at each end and revolves on ball bearings, causing a minimum of friction and wear. The adjustment to feed wheel toward commutator is to loosen wing nut on body of device and by moving the stud which operates an eccentric bushing, which causes the working parts of this device to move forward toward commutator. In this manner a cut can be taken as fine as is desired.

The ball-bearing cups can be adjusted by removing one screw on the back end of device and is adjusted with wrench which is furnished with each device to take up wear in hardened ball-bearing cups.

HYDRAULIC BILLET SHEAR.

A MACHINE recently built and designed by the United Engineering & Foundry Co., Pittsburg, Pa., is illustrated herewith. Figure 1 is a view on the entering side and Figure 2 on the gauge side. It is adapted for cutting hot flats and squares as they come from the furnace, for a special continuous repeating combination sheet bar and billet mill. The knives have four cutting edges 24 inches long. The upper knife head is operated by means of an 18-inch hydraulic cylinder, with a push back cylinder of suitable size, arranged conveniently within the cover plate of the shear head. The feed rollers, as shown, are directly connected, the bottom roller being operated vertically by means of a small hydraulic cylinder, while the top roller is made adjustable for the different thicknesses of material being cut. The machine is also equipped with an adjustable gauge of simple design, easily operated and securely carried on the main frame of the shear.

The hydraulic power used to operate this shear gives it important advantages over a geared shear. The liability of breakage is eliminated, as the shear will stop before it will break any part. Further, the space occupied is reduced to a minimum, a geared shear of the same capacity taking up considerably more space.



Single Spindle Centreing Machine.

PHOENIX CENTREING MACHINE.

ONE of the machines recently placed on the market for the lessening of labor and ease and quickness of operation is the single spindle centreing machine manufactured by the Phoenix Manufacturing Co., Hartford, Conn. It is designed to centre round, square,

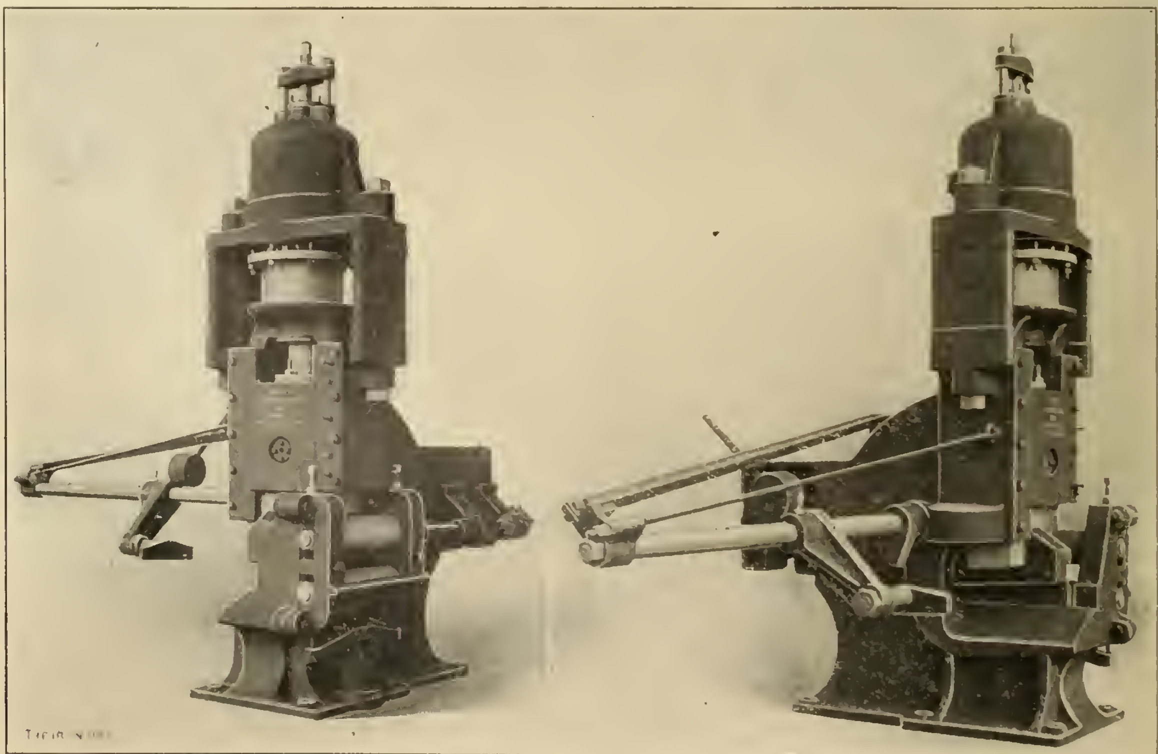
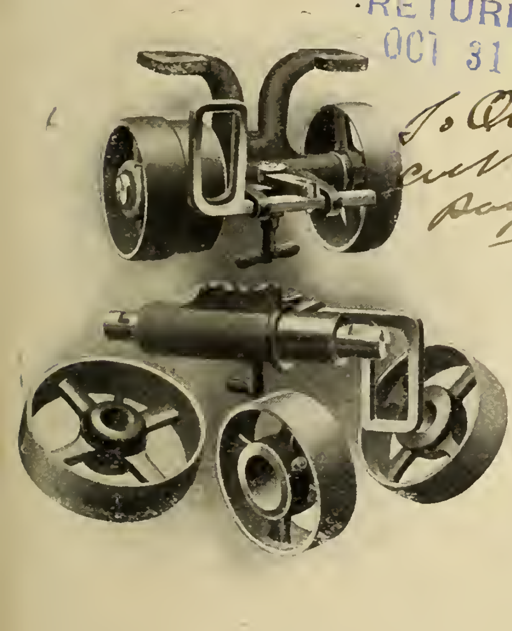


Fig. 1—Entering Side. A New Hydraulic Vertical Biller Shear. Fig. 2—Gauge Side.

hexagonal, octagonal or oval pieces. This machine is shown in the illustration from which a splendid idea of what the machine really is may be obtained. Before this machine was invented it was common practice for a man to spend considerable time and then not have the work done as well as can be done in a few minutes with this centering machine. For instance, a man has a piece 30 or more inches long and say 2 inches in diameter. He takes it to a vise, screws it in, then goes to his drawer for a prick punch which he may find dull, in which case the grindstone is sought, where he often finds some other ahead of him, giving him an opportunity to talk or take his ease, as he may be inclined. When the punch is finally ground he returns to his vise and perhaps borrows a pair of dividers to find something near the center for his punch.



Phoenix Counter.

He will often get a piece of chalk, that the divider marks may show more plainly. If bench centres are not in a handy place, he may go to a hand lathe, but more likely to an engine lathe, to see if it runs true enough. As it most likely don't a few trips back and forth to the vise may be the result and the piece is ready to use the drill and reamer that may be handy, but just as likely not, and besides that a chuck may have to be hunted, that very likely is in use at the drill press and must be borrowed as it is only needed a short time. When all is ready some one has to come and help, either to guide the end being drilled or feed the foot block at the other end, and after a longer or shorter time the piece is drilled in say 34 minutes, when the machine without any hurry would have done the work better in less than one minute.

Now suppose you have a shorter piece to centre. In the old way it would be a case of hustle to centre in seven minutes, everything being propitious, or a waste of not less than six minutes to do the work imperfectly the greater number of trials. An average of one piece a day would mean about 34 hours to the year or an actual money value at current rates of $20.40 as against the machine cost of less than $3, being a large percentage.

IMPROVED RE-GRINDING VALVES.

To Owner Cut Book 42 Page 42

The Lunkenheimer Co., manufacturers of high grade engineering specialties, Cincinnati, Ohio, have made a number of improvements in their re-grinding valve. These changes, although not at all radical, will be of interest to those using steam specialties.

The weight of the valve has been increased somewhat as an additional precaution against rough handling while they are being attached, and the medium pattern as now made will stand a working pressure of 200 pounds while the extra heavy pattern stands 300 pounds pressure per square inch. The shape of the valve has also been changed, with the result that the appearance of the valve has been improved and also the area of the passage through the valve increased. The pipe threads have been made considerably longer to assure a perfect joint between the pipe and the valve, and at the same time to overcome the danger of stripping the threads in careless attaching. The hand wheels of all sizes of valves are now provided with lock nuts which facilitates the taking apart of the valve for repairs and assembling.

Referring to the sectional illustration, it will be noticed that the hub which carries the operating stem is secured to the body by a union connection, which, in turn, screws over the shell of the valve body. By means of this construction it is impossible for the hub and the body to become corroded together, as the thread which holds the union ring to the body is protected at all times from the action of the steam, the joint being made between the flange on the hub and the neck of the body. This connection also acts as a tie or binder in screwing over the body, and tends to make the valve rigid and strong.

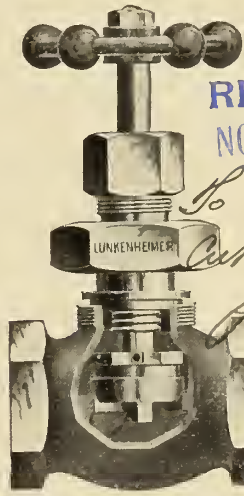
The disc is held loosely to the stem by means of a lock-nut, and will therefore adjust itself to the seat very readily, and a tight joint can be relied upon.

The stem is fitted with a very strong, durable and long thread, and the manufacturers emphatically state that the valve is very easy to operate, and that there is practically no exertion necessary to tightly close even their largest valves. The reason for this is that the hand wheels are so proportioned in respect to the seat opening, that no additional leverage need be applied to the hand wheel to facilitate the operation of the valve.

To re-grind the valve, the bonnet ring is unscrewed, and the trimmings are removed from the body. A wire or nail is placed through the lock-nut and stem, a little powdered sand or glass and soap or oil is placed on the disc, and the trimmings are again placed in the valve and re-ground.

The bonnet has a small rim or projection on the bottom thereof, which acts as a guide on the inside of the valve neck while re-grinding.

The seats in the valve-bodies are very small when open or closed, and to pack while the steam is flowing through the valve the same is opened as wide as possible, when the shoulder at the top of the stem forms a seat beneath the stuffing box.



To Owner Cut Book 42 Page 42

Improved Regrinding Valve.

The material used is of the highest grade of bronze composition, and the workmanship is in every respect commendable. Before being sent out of the factory every valve is thoroughly tested and inspected, the stuffing boxes are packed and they are ready for immediate use.

The company have in connection with their plant a complete physical and chemical laboratory, which enables them to manufacture their products of such composition as is best adapted to withstand the chemical actions, strains, etc., to which the various products are subjected. The laboratories also enable the company to guarantee their products in every respect.

One of the largest American farm implement companies is negotiating for a site and power, intending to locate a large plant at Fort William.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

KEEWATIN Flour Milling Co. have closed a contract for the machinery of one of the largest flour mills on the continent. The equipment will be equal to 40,000 barrels a day, and provision has been made for a further output of 20,000 barrels. The successful tenderers were the Allis-Chalmers Co., of Milwaukee, who have built all the large flour mills in the United States. The amount involved will be about $225,000. A considerable portion of the machinery will be constructed at the works of Allis-Chalmers-Bullock, Limited, in Montreal. The contract calls for the installation of the universal bolter system throughout. The power is derived from the Lake of the Woods, and wherever possible electricity will be used in the operation of the plant.

Two new elevators are being erected at Davidson, Sask.

The Marysville smelter in East Kootenay is to be enlarged.

Porter & Son, Winnipeg, will build a large wholesale warehouse.

Thornton & Douglas, Hamilton, are building a factory to cost $13,000.

E. J. O'Neill, Guelph, is to erect a large cement warehouse in that city.

Arsenical iron ore has been discovered on Bowen Island, near Vancouver, B.C.

The Elk Lumber and Manufacturing Co. will build new mills at Hosmer, B. C.

A $20,000 concrete bridge is to be built across the Rideau River at Ottawa.

The Manning Wood Fiber Co. of Toronto established a factory at Owen Sound.

Active work is progressing at the new gold find at Seal Harbor, Guysborough county, N.S.

Copp, Dixon & Co. have decided to rebuild their wood working factory at Sackville, N.B.

A company has been incorporated at Truro to build a railway to Parrsboro and to Macean.

The Western Milling Co. is erecting a brick mill at Calgary with a capacity of 500 barrels daily.

The Skedden Brush Co., Hamilton, have taken out a permit for the erection of a $10,000 factory.

The Toronto Gasoline Engine Co. intend removing their plant from Toronto Junction to Toronto.

The C.P.R. have decided to immediately construct a line of railway into the town of Macleod, Alberta.

The Southwestern Traction Company have purchased a site for a power house at Glanworth, near London.

Grand Forks is likely to be the site chosen for the new smelter to be erected in the Boundary district by the Dominion Copper Co.

William Gray & Sons, carriage manufacturers, Chatham, intend establishing a branch factory at Winnipeg.

A new brick planing mill 80x160 feet and costing $20,000 is to be erected at Sarnia by W. F. Lawrence.

The building permits issued in Montreal during the month of September show a total value of $635,000.

The town of Chatham is considering the spending of $35,000 on the enlargement of its electric light plant.

A by-law has been carried by the town of Harriston to loan the sum of $10,000 to the Canada Stove Works.

The Nova Scotia Steel & Coal Co. are opening another new colliery between Sydney No. 3 and Little Bras d'Or cut.

Woodstock, Ont., has passed a by-law voting $50,000 improvements for water works plant. A large reservoir will be built.

Red Deer, Alberta, ratepayers have voted to spend $10,000 to aid the erection of a flour mill and elevator at that point.

The Dominion Geological Survey staff is trying to locate an iron belt in New Brunswick similar to the one discovered in Nova Scotia.

J. A. Brown is making extensive alterations in the New York block on Granville street, Vancouver, the work costing $20,000.

Chadwick Bros., brass founders, have just completed a large and up-to-date plant in Hamilton, and are commencing manufacturing on an extensive scale.

The Canadian Fairbanks Co. have in course of installation a 40 h.p. Fairbanks-Morse gasoline engine in the plant of the Boston Last Co., Richmond, Que.

The building occupied by the St. Lawrence Iron Works, Montreal, was destroyed by fire last week, entailing a loss of $6,000, partly covered by insurance.

Messrs. McLachlin Bros. of Arnprior will construct a concrete dam and steel bridge across the Madawaska River. The cost of the undertaking will be about $75,000.

Swan, Church & Co., contractors for the metal lathing in the Singer Sewing Machine Co.'s works at St. Johns, P.Q., report that the work is almost finished.

W. J. Pendray's large silk works at Victoria, B.C., are to be enlarged and $45,000 will be spent on a new plant to be established at Sehl's Point in Victoria, B.C.

Employes of the Cumberland Railway Co., at Springhill, N.S., are again on strike. The men demanded an increase of wages, but the company would not give all that was asked. About 1,400 men are idle.

The Victoria Cement Co.'s works at Tod Creek, near Victoria, B.C., are being doubled in size, machinery being added to increase the output to 600 barrels daily.

The Grosvenor Flats, which were the scene of the long labor strikes in Montreal, are now almost finished, some of the contractors being already in shape to knock off work.

Negotiations are on for the taking over of the buildings at Port Hope recently occupied by the Canada Radiator Co. by a new industry which will employ a large staff of men.

A new woodenware factory has been established at Hampton, N.B., to manufacture pails and tubs. The capital stock is $21,000, and W. J. Brown, Hampton, is general manager.

R. M. Brown and J. G. Milne of Toronto propose to establish a grist mill at New Liskeard, and may also install an electric plant to furnish the town with power and light.

Port Elgin has carried a by-law to raise $40,000 to build a squr line of railway connecting the Grand Trunk with the harbor, and also for the establishment of a sawmill.

The Deseronto Board of Trade have chosen these officers for next year: President, John Dalton; vice-president, W. J. Malley; treasurer, A. G. Bogart; secretary, H. R. Bedard.

Robert Stewart, Guelph, has secured the contracts to erect several new buildings at Cobalt, amongst them being an 80-room hotel, a modern bank building and several residences.

The New Brunswick company operating at LePreaux, N.B., have made a number of borings to test the quality and extent of the iron deposit. The deepest boring is 1,000 feet.

It is said that a large manufacturing plant may be established at Hull, Que., by an American company. About 1,000 hands will be employed in making metal tubes, according to the report.

Prominent officials of the Plymouth Cordage Co. were in Welland this week concluding arrangements for the establishment of the large binder twine factory to be erected in that place.

The C.P.R. is erecting a new machine shop at Peterboro, covering an area of 100 x 60 feet. It is considered necessary for the repairs of locomotives in service between Montreal and Toronto.

The Welland Electric Power Transmission with headquarters at St. Catharines contemplate running power lines to Hamilton and Toronto. The company is backed by New York capital.

The Thornton & Douglas Co., manufacturers of clothing, etc., Stratford, Ont., have purchased a large site in Hamilton, Ont., upon which they will erect a three-story factory building 110x60 feet.

Richard Ricardi, of Richmond, Va., who manufactures clothes pins and has both a Canadian and an American patent, is thinking of moving to Canada and views Ottawa with a good deal of favor.

The company which is to undertake the development of the Kaministiqua Falls near Port Arthur has let contracts to the Canadian General Electric Co. for

erecting equipment worth about $200,-000.

An expert in the employ of Mackenzie & Mann is inspecting a rich iron field near Port Arthur, the intention being to secure a source of supply for great industries to be established at that quarter.

It is the reported intention of the Lake Superior Corporation's Algoma Steel Company to build a fifty-ton charcoal iron furnace at its plant at Sault Ste. Marie, Ont., especially to take care of the output of the company's charcoal kilns.

To answer the growing demand in Canada for Paroid Roofing, F. W. Bird & Son have purchased nine acres of land in Hamilton, and are now completing one of the most modern tinent.

The Dominion Coal Co. has commenced the work of sinking a new shaft at Donkin, Dominion No. 6. It is to tap the Emery seam which underlies the Phalen at this point at a depth of about 130 feet.

Buildings being erected in Dauphin, Man., this year are valued at $132,000, an excellent growth for this western town. In all 70 buildings have been erected, most all valued at between $1,-000 and $4,000.

The share holders of the Brandon Binder Twine Co. are considering a proposition which may result in a reorganization of the company. Only one tender was received in reply to the offer to sell the plant.

The Brant Milling Co., of Brantford, are to erect a new brick two-storey warehouse and cooperage shop. Up-to-date and fireproof materials will be used throughout. Modern cooperage machines will also be installed.

Adair Mfg. Co. has been organized with a capital of $75,000, to erect iron works in Revelstoke and manufacture stump burners. The company will also establish a foundry and place air-tight heaters on the market.

Parry Sound voted to spend $20,000 to improve the electric light plant, and to grant a bonus of $25,000 to the James Bay Railway, who agree to make Parry Sound a divisional point, and erect machine and repair shops.

A new sawmill will soon be added to the large number already doing business on the Fraser River. It will have a capacity of 35,000 feet per day and will be owned by the Maple Leaf Lumber Co., Maple Grove, B.C.

The contract for the supply of electrical machinery for street lighting purposes has been awarded by the city of Victoria, B.C., to the Hinton Electric Co. The plant is to be of the Canadian General Electric manufacture.

Grand Trunk officials say the failure of the Dominion Steel Co. to deliver 25,-000 tons of rails from June to September has forced the railway to order 5,000 tons from the United States on which they must pay a duty of $35,000.

The Manitoba Peat Company's plant at Fort Frances has commenced operations. The plant is operated by electricity and contains a large amount of machinery and several storage sheds. The company owns about twenty square miles of peat bogs in the vicinity.

The Canadian Pacific telegraph service is to be improved very shortly by the stringing of another copper wire from the east to Vancouver. The first copper circuit from Montreal to the coast was completed a couple of years ago.

The Newfoundland Government has about completed the laying of a cable from Canso to Port Au Basque, Nfld., to give the colony telegraphic communication with the mainland independent of the service of the Anglo-American Co.

The plant of the Canada Car Co., Montreal, is rapidly nearing completion. Much of the work of equipping the immense shop is now in progress, and it is fully expected that they will be in full running order inside of a couple of months.

It is understood that the Nova Scotia Coal & Iron Co. are proposing to establish a shovel factory at North Sydney, N.S. Picks and miners' tools would also be manufactured for the trade in the Maritime Provinces and Newfoundland.

North Vancouver, the promising suburb of the Terminal City, situated across the inlet, is to have telephones as well as electric light and street cars. This municipality has a fine water service of wood pipes installed last year at a cost of $50,000.

The rumor that the Steel Trust intends to locate in Canada has been revived. Sandwich is to be the site of the new plant. According to a Detroit despatch land is being acquired along the Detroit River and a very large plant will be established.

The C.P.R. has ordered rolling stock from the Angus shops at Montreal amounting in value to $3,000,000. The order includes 25 parlor, sleeping and dining cars, 90 passenger coaches and 3,000 freight cars. Twenty-five additional locomotives are already on order.

The Fowler Canadian Co. propose erecting large additions to their factory at Hamilton, the cost of which will be between $50,000 and $60,000. The company now employs about 150 hands and the new additions are made in order that they may enter the beef slaughter business.

Finley & Spence, architects, Montreal, are inviting tenders for the erection of a large Armory for the 5th Royal Scots, to be situated on Bleury street. The building will be an imposing one, containing drill hall, gymnasium, shooting alley, bowling alleys, and swimming baths.

That the mechanical stoker has reached such a state of perfection as to be considered indispensable in the equipment of modern boiler plants is indicated by the large number of orders booked by the Westinghouse Machine Co. for the Roney stoker, a type of their exclusive manufacture

September 12 will long be remembered by the people of Fort William as one of the greatest days in the history of the town, Sir Wilfrid Laurier having turned the first sod of the G.T.P. The town presented a magnificent appearance with its thousands of yards of bunting and British flags.

Zinc treating works at Frank, Alberta, will be in active operation shortly and the Canadian Metal Company are preparing to treat zinc ores of all grades from the mines in British Columbia. The company owns its own mines but will also handle the output of independent mining companies.

It is reported that the Baylis Pulp & Paper Co., of Binghamton, N.Y., have purchased three hundred miles of spruce timber on the River Ste. Anne, thirty miles from Quebec city, at a cost of about $1,000,000. The company will establish pulp and paper mills in that vicinity to cost $700,000.

Thos. Lawson & Sons, Limited, Ottawa, are at present engaged on the iron work for the stairs of the new Carnegie library. They are supplying a number of the municipalities with hydrants and valves for their water works systems, among them being Buckingham, Gatineau Point, Cardinal and Arnprior.

The ratepayers of Arnprior, Ont., have voted favorably on a by-law granting a loan of $35,000 to the Montreal Suspender and Umbrella Mfg. Co., in consideration for which the company will erect a large factory there. The manufactures now carried on in Montreal, Ottawa, and Sorel, Que., will be removed to Arnprior.

The Dominion Natural Gas Company by an agreement signed and delivered will come into control of the Galt Gaslight Company's plant on October 1. The Dominion people have leased the Galt plant, and so soon as the mains are laid to the town, about November 1, will supply consumers in Galt at 35 cents per thousand.

The report of lake commerce through canals at Sault Ste. Marie for the month of August as compiled by the engineers' corps, U.S.A., gives the total freight passing through the United States and Canadian canals as 6,327,595 net tons. Three thousand and eighty-eight vessels passed through having a registered tonnage of 5,038,651.

The annual report of the Canadian Electric Light Co., Quebec, reveals a very prosperous condition of affairs highly creditable to the directors and satisfactory to the shareholders. It shows an increase in revenue, and, therefore, presumably in business, of close upon $8,000, and a surplus on the current year's operations of $2,041.

American glass manufacturers are said to be behind the proposition to establish a glass factory at Cayuga. Excellent glass sand is said to exist in large quantities near Cayuga while the supply of natural gas being piped through the district by the Dominion Natural Gas Company makes available a cheap fuel suitable for manufacturing purposes.

A Halifax despatch says the Dominion Iron & Steel Co.'s billet mill, which has been closed down for repairs since Aug. 8th, has resumed operations. The starting of this mill caused a reduction in the staff of the new rail mill, and consequently the output of the latter will also be reduced through inability to get sufficient steel from open-hearth furnaces.

A valuable deposit of fire clay is stated by the local press to have been found within the limits of the town of Baddeck, C.B. It is located on property owned by Mr. C. M. Campbell, and a

depth of 12 feet of material has been found so far. The Dominion Iron & Steel Co. are making tests of the clay, which is described as of superior quality.

Negotiations have been concluded for the leasing of the Lake Superior Corportion copper plant at the Soo to the Canadian Nickel Co. for the purpose of experimenting in copper and nickel refining by means of electricity. The experiment will start about Sept. 15. If successful, it is intended that the Lake Superior Corporation shall introduce the system.

A great shortage of cement on the markets in Pacific coast cities has resulted in important public work being suspended, and a large amount of English and Japanese cement had been exported from British Columbia ports. The works of the Vancouver Portland Cement Co. are being enlarged owing to the increasing demand throughout the Province.

The Nova Scotia Oil & Gas Co. have reached a depth of 300 feet in the third well to test the oil formation at Cheverie, Hants county, N.S. Two previous attempts to locate oil were unsuccessful, owing, it is stated in a circular from the secretary, Dr. Hayes, to large bodies of salt water encountered in both cases. One of these wells was put down 2,300 feet.

At the Tariff Commission recently concluded in Vancouver, Mr. C. F. Jackson, of the Vancouver Engineering Works, asked for protection on mining machinery. He explained that the Vancouver Engineering Works were now manufacturing monitors, giants and elevators for hydraulic mining, and, as these are on the free list, was desirable that a duty should be imposed.

The saw mill erected by the Messrs. Babbitt at St. Marys, near Fredericton, N.B., is about completed. The boiler and other machinery will be in working order in a short time. The new mill is 30 x 100 feet in dimensions, and will be equipped with the latest machinery. In addition to the mill there is being erected a neat office, blacksmith and machine shop, and a tenement house.

Already the magnificent building record established last year at Winnipeg is being approached, only about $200,000 being required to equal last year's total of $9,500,000. Last Monday twenty-six permits were issued for buildings aggregating in value $50,000. Comparing the figures with the corresponding date last year, it is found that this year's total exceeds that of last year by almost $1,500,000.

The construction of the power plant at Kaministiquia Falls near Fort William by the company organized by Messrs. C. R. Hosmer, H. S. Holt and F. W. Thompson will now be rushed as rapidly as possible. The company has let contracts to the Canadian General Electric Company for the generators, exciters, switchboards, etc., the total cost being, it is understood, in the neighborhood of $200,000.

Contracts have been let for the erection of the new factories at Welland for the Plymouth Cordage Co. The buildings will be of brick with concrete foundations, and the company's entire frontage along the Welland Canal will be used for wharves on which large warehouses will be erected. A large number of dwellings will also be built for the use of employes, of whom there will be about four hundred.

The Canada Car Co. will commence about the middle of next month the construction of 1,000 new cars for the Grand Trunk, and after their completion work will be at once begun on 2,000 freight cars for the Grand Trunk Pacific. The G.T.R. placed its order for these cars last Spring, and the plant of the car company is now far enough advanced to make a start on the order for 1,000.

The Dominion Coal Co. and the Nova Scotia Steel & Coal Co. have increased their shipments to the St. Lawrence, during the past four years, in similar ratio. The increase for each is about 40 per cent. It is fortunate for Nova Scotia that the Montreal market is a continually expanding one. It took over a million and a half tons of Nova Scotia coal last year, and it will take considerably more this year.

The Londonderry Iron and Mining Co. is erecting a large shaft house on the property of F. Wheelock at Torbrook Mines. The drilling on the shaft is being done by steam. A lot of machinery will be installed there in a few days, including an air compressor. An engineer to survey railway extension to the mines is expected, after which Mackenzie & Mann will start work on the road with five hundred Italians.

The Canadian Fairbanks Co., Montreal, have just closed a contract for all transmission material used in the new plant of the Boston Last Co., Richmond, Que. This includes Fairbanks' Universal Giant Hangers, Oneida Steel Split Pulleys, Universal Giant Friction Clutches, shafting, coupling, etc. A similar order has also been received from the Dominion Coal Co., for the installation of transmission material in their plant at Sydney, C.B.

Dr. Haanel, Dominion Superintendent of Mines, points out that in the United States some anxiety is beginning to be manifest about the iron supply. Formerly they would not look at ore containing only 55 per cent. of iron, but now they were very glad to get it. Very soon they would be willing to take ore with much less content of iron. In the United States also much less discrimination is being shown with respect to the sulphur content of ore.

Krug & Crosby, Hamilton, have found it necessary to move into larger premises, so have secured a shop at the corner of Bay and York streets. A new drill, a larger and improved lathe, and other machine shop supplies, have been added to their equipment, with the result that they are now in even better shape than formerly for the manufacture of planer vises, sensitive friction drills, power hack saws, positive drive drilling and tapping chucks, as well as for general repair work.

The American Car & Foundry Co. have recently added to their equipment at the Madison plant, Granite City, for the construction of steel and composite cars, among the equipment being 100 Boyer long stroke riveting hammers, manufactured by the Chicago Pneumatic Tool Co. Orders for the hammers above mentioned were forwarded after a careful test of all the various makes of riveting hammers on the market, the said test demonstrating the Boyer to be the most rapid and efficient of any other tools on the market.

Two building permits aggregating $261,000 were issued from the Building Inspector's office at the City Hall, Montreal, recently. Both buildings are to be erected in the uptown section of the city. The one which will cost $161,000 is the new and magnificent Nurses' Home for the Royal Victoria Hospital. The other permit is for what will be known to be the Lindsay building, on St. Catherine street, for $100,000. It will be built of sandstone of seven stories high, and when completed will be entirely used for offices.

An order in council has been passed in reference to the royalty on gold mined from quartz in the Yukon. The order provides that a royalty will be collected on gold produced from claims upon which $25,000 has been spent for machinery, etc., within five years from the passing of the order. It is also provided that royalty is abolished with respect to copper claims upon which $50,000 has been spent within ten years. The order is to encourage quartz mining, which involves a greater outlay of capital to produce better results than placer mining.

A Detroit manufacturer of machine specialties proposes to build a modern branch factory at Walkerville. Three hundred hands will be employed. In an interview he said : "Canadians owe it to themselves to adopt the most economic methods in producing power. The development of the waterpowers will be worth millions to the country, for every horse-power developed is equivalent to five pounds of coal per hour. With the capital turned into local channels which now goes to the United States for coal, the country will profit inestimably."

The Canadian White Co., Limited, of Montreal, have been awarded the contract for the new head office building of the Federal Life Assurance Co., Hamilton, Ont. Finley & Spencer, of Montreal, are the architects. This building will be an eight-storey modern steel construction, fireproof structure. The Canadian White Co. takes the entire contract and turns the building over for occupancy not later than Aug. 1, 1906. This company has also been awarded the contract for the new car shed for the Montreal Street Railway Co.; Marchand & Haskell, architects.

The Dominion Iron & Steel Co. of Sydney have contracted with the Grand Trunk Railway to supply 25,000 tons of steel rails, to be delivered next Spring. It is authoritatively stated that the Grand Trunk Pacific have placed an order with the same company for steel rails to the amount of $1,000,000, delivery to be extended for a period of five years. The Dominion Co. have refused to accept an order for the delivery of a large quantity of rails of light weight required by the Chinese Government for an extensive railway system being constructed in that country.

P. J. Powers & Co., Ottawa, have just completed a large number of acetylene gas lighting buoys for the Dominion Government, and expect to commence on another order at an early date. They have in course of construction a

new iron flume, 9 feet in diameter, 75 feet long, made of 5-16 inch material, reinforced with 5-inch steel angle every 12 feet. Between these angles are saddles of concrete which will serve as rests for the foundation of the plume. The buoys mentioned are of the Thos. L. Wilson patent, who has been in receipt of orders for his buoys from all over the world.

About seventy years ago one of the big lumber dealers started a raft of white oak logs down the Lindsay River so late in the season that it was caught in the ice and sunk. Since then the raft had never been located until this year, when it was found after a year's search. The value of the timber in this raft is estimated to be $1,000,000. It contains several thousand sticks of white oak cut and squared. Each stick contains about 160 cubic feet, worth at the present time $1 per cubic foot. Barges with tackle and hoisting engines will be used to bring the logs to the surface, and already steps have been made to accomplish this.

The Canadian Westinghouse Co. have recently received a large number of orders in Canada, among which are the entire equipment for the new grain elevator at Windmill Point, Montreal, consisting of about 1,400 h.p. in motors, electrical drive being used throughout, as well as all the electrical apparatus connected therewith. The firm is installing an addition to the present power plant at Verdun, consisting of 155 k.w., as well as a switchboard. At the Canada Car Co.'s works near Montreal, they have in course of installation about 100 motors, to be used for driving machinery in the different departments of this enormous works.

According to Mr. Hugh Allan, the turbine steamers running during the past season for the Allan Line have given satisfaction beyond the expectation of the firm. This statement is borne out by the fact that the Allan Steamship Line have already taken steps to build two other turbine steamers to add to their present fleet running between Liverpool and Montreal. They will have a speed of 18 knots, which is 1 knot faster than the two vessels now in operation, and, besides, will have a greater tonnage. They are to be built in British yards, and will, it is expected, be ready for use in the year.

A half a million in new buildings and another $100,000 in city improvements will be the record of Brandon's prosperity this year. This amount will be reached and probably well exceeded before operations have closed for the season of 1905. Although scarcely up to the figures of last year, when the amount paid over for building operations and municipal work reached almost $700,000, which included an $80,000 wing to the asylum, this year's record is remarkably good. The largest building in this year's list is the new Y.M.C.A. building at $72,000, the remainder ranging from $35,000 down.

The factory of the Munro Wire Works, Limited, who recently began business in Winnipeg, presents a busy scene of industrial activity and the enterprise promises to develop quickly into one of the most important of the local manufacturing institutions. The factory is splendidly equipped from the power house to the fifth flat. The company manufacture all manner of steel and wire fencing, grills, gates, etc., but make a specialty of wire bed mattresses, and their factory is kept running to its fullest capacity, in fact such a demand has been created for their output that larger premises are in contemplation. A large export trade to Japan is being developed.

According to a conservative estimate, it would take five hundred thousand tons of steel rails to lay the Grand Trunk Pacific Railway from Moncton to the Pacific Coast. It takes one hundred and twenty-five tons of 80-pound rails to lay one mile of track, and, as the total mileage of the road will be, as near as can be at present foreseen, about four thousand miles, the total amount required is apparent. In view of this, it is interesting to calculate whether or not the two steel rail mills in Canada can furnish this supply. Since the Dominion Iron & Steel Co. began to make rails last Summer, their total output has been taken by the G.T.R., and has amounted so far to a little more than twenty thousand tons.

The dumping clause as regards steel billets is in operation again, it having been suspended between July 24 and September 30, by a bulletin authorizing collectors of customs to grant permits for the importation of steel billets for use in rolling mills or forges, on payment of the ordinary duty, without special duty, subject to the condition that the quantity imported for any one such rolling mill or forge shall not exceed one-quarter of the total quantity of steel billets rolled or wrought by such mill or forge during the calendar year 1904—the quantity to be established to the satisfaction of the collector at the port of entry by a declaration by a principal official of such rolling mill or forge.

The trade returns for the last fiscal year as compared with 1904 show a remarkable decline in the imports into Canada from the United States of the leading implements for farm use. It may be significant, that no complaint was made by the western implement representatives while the Tariff Commission was sitting at Winnipeg, although several other manufacturers were heard from. Taking the ten most important items of import for farm use, which must of necessity be the most important in the consuming west, one finds that the total in 1904 was $4,006,534, while in 1905 it was only $2,804,425, a decrease of $1,202,109, or about one-third. In nearly every item there was a decrease, showing the general trend in the direction of home purchasing.

There are now fourteen iron and steel-making companies with which ledger accounts are kept by the Department of Trade and Commerce at Ottawa. The names of these companies with the total amount which each has received in bounties during the last seven years—1898-1905—are as follows: N. S. Steel Company, $276,278; N. S. S. and C. Co., Limited, $596,693; Mineral P. Co., Pictou, N.S., $7,378; Dominion I. and S. Co., Limited, $2,252,455; Canada Iron Fur. Company, $447,657; Ontario Rolling Mills Co., $18,712; Hamilton Blast Furnace Co., $203,080; Hamilton S. and I. Co., Limited, $846,144; Deseronto Iron Co., $133,134; John McDougall & Co., $26,264; Electric Reduction Co., $2,222; Algoma Steel Co., Limited, $328,740; Londonderry I. & M. Co., $64,493; Montreal Roller Mills, $1,545; total, $5,204,755.

R. E. Harris, president of the Nova Scotia Steel Company, completed an important deal in Newfoundland last week, when he purchased from the local owners the submarine ore areas on the north of Belle Isle. The ore deposits on the island are beginning to run short, and from present appearances it looks as if the supply will last but a few years longer. It is this that has compelled the company to look elsewhere, and they will now determine whether or not the ore runs out under the sea. One of their tunnels is about one hundred feet from the sea and about the same distance below the sea level, and the ore has increased in thickness by nearly two feet since going underground. Should the venture prove a success, the company will have a supply for many years, but it will cost them more than $100,000 to prove that the ore is workable.

The Dominion Copper Co., successors to the Montreal & Boston Co., have resumed operations in the Boundary district, under the management of Samuel Newhouse. The principal work at the present time will be in the line of development to permit of the shipment of 1,000 tons of ore per day to the company's smelter. This smelter will resume operations within a few weeks in order to determine the best method of treating the ores. The management have practically decided to build a new smelter, as the old one, which is said to have cost about $200,000, is inadequate, and is not adapted to economical operation. Indeed, the records show that the smelting operations of the old Montreal & Boston Co. were not profitably conducted. The new smelter will be built either at Great Falls, where the Granby smelter is situated, or at Midway.

To keep up with the demand on railway construction and renewal account will severely tax the capacity of Canada's two rail mills. Already it appears orders are being sent to outside mills, because of the impossibility to get them filled in time at either Sault Ste. Marie or Sydney. The Grand Trunk Pacific Railway Company recently gave a contract for 5,000 tons to the United States Steel Corporation. Two other lots, of 5,000 tons and 8,000 tons respectively, have been purchased in the United Kingdom, and a press agency reports Canadian inquiries in Scotland for quotations on a 30,000-ton order. On the C.P.R. system track-laying is going on. The portion of the main line between Winnipeg and Fort William is being double-tracked, though for the completion of that work three years will be required. On the company's branch line from near Kleinburg to Sudbury construction is being pushed rapidly along.

Everything about the works of the Wm. Hamilton Mfg. Co., engineers and machinists, Peterboro, Ont., presents an air of unusual activity. All departments are worked in full force, and with the volume of orders on hand it is evident that this state of affairs must continue for many months to come. The biggest demand at present is for the Samson turbine water wheel, while there are steam tension band mills and saw mills being called for to considerable extent. Among recent contracts for Samson turbine water wheels are: One for Trent

River Paper Co.; one for Geo. R. Clark, Dawson City, Yukon; one for Rolland Paper Co., St. Jerome, Que.; two for corporation of Orillia; power plant for corporation of Revelstoke; one wheel for Jas. A. Brown, Vancouver; one 26 in. wheel for Georgetown Sawmill Co., of Port Simpson, B.C. Steam tension band mills: Two for John B. Smith & Sons, of Callander; one for Small & Bucklin Lumber Co., New Westminster, B.C. Sawmills: Small & Bucklin Lumber Co., New Westminster, B.C.; John B. Smith & Sons, Toronto.

Allis-Chalmers-Bullock Annual.

At the annual meeting of the shareholders of Allis-Chalmers-Bullock, Limited, the following were elected directors: Lieut.-Col. F. C. Henshaw, W. C. McIntyre, Edgar McDougall, J. W. Pyke, Phelps Johnson, William McMaster, Henry J. Fuller, Alex. Pringle, all of Montreal; W. H. Whiteside, president of the Allis-Chalmers Company; Charles Allis, J. A. Milne, all of Milwaukee; George Bullock, president of the Bullock Electric Manufacturing Company, and J. S. Neave, of Cincinnati; E. D. Adams and W. W. Nichols, of New York. At a subsequent meeting of the directors, Mr. George Bullock was re-elected president, and Mr. Edgar McDougall vice-president. The reports were all satisfactory, showing that the company had done very well in the first year of its existence, and that the business was constantly increasing. The company last year spent over $110,000 on the plant, and opened sales offices in Halifax, Toronto, Winnipeg, Nelson and Vancouver.

AN ENQUIRY.

938 King Street West,
Toronto, Sept. 27, 1905.

Dear Sir,—As I am a subscriber to your Canadian Machinery, I write to ask if you could assist me by letting me have the address of the gentleman who has charge of the inquiry department attached to the Stationary Engineers' Union, and also the name and address of the department where I could obtain information as regards marine engineers obtaining their certificates.

Hoping that I have not, or will not, cause you any unnecessary trouble, I remain, Yours truly,

(Signed) H. J. PICKARD.

Full information regarding the Canadian Association of Stationary Engineers may be had from the secretary, Wm. Inglis, 554 Bloor street west, Toronto, while any information regarding the Marine Engineers might be had from Neil J. Morrison, St. John, N.B.

Prizes Awarded.

The prizes offered by Engineering News and the Cement Age, of New York, for the best papers on "The Manufacture of Concrete Blocks and Their Use in Building Construction," have just been awarded by the jury, which was composed of Messrs. Robert W. Lesley, past-president of the American Cement Manufacturers' Association; Richard L. Humphrey, president of the Cement Users' Association; and Prof. Edgar Marburg, secretary of the American Society of Testing Materials.

The first prize of $250 was won by a paper by Mr. H. H. Rice, of Denver, Colorado, secretary of the American Hydraulic Stone Co. The second prize of $100 is given to a paper by Mr. Wm. M. Torrance, C.E., of New York City, assistant engineer in charge of concrete-steel design for the Hudson Tunnel Companies.

Companies Incorporated

The Manson-Campbell Co. have been allowed to increase the capital stock of the company from $300,000 to $500,000.

The Martin-Senour Co., capital stock $50,000, purpose to manufacture and deal in paints, colors, chemicals, varnishes, oils, glass and all ingredients and products thereof.

Boston Varnish Company, capital stock $50,000, for the purpose to manufacture and deal in paints, chemicals, varnishes, oils, glass and all ingredients relating thereto.

V. J. Hedden & Sons Co., of Toronto, capital $100,000; building contractors. Provisional directors: R. W. Berlmer, H. C. Whitten, D. R. Gillie, H. W. Ivor and J. C. Coveny, all of Toronto.

The Canadian Glass Manufacturing Co., Montreal, capital stock $25,000, purpose to manufacture and sell all kinds of glassware, and all material and machinery connected with the same.

The Mouterde's Electric Accumulator Co., Limited, of Montreal, have been incorporated with a capital stock of $250,000, for the purpose of manufacturing and dealing in electric machinery, etc.

The North River Power Company, Limited, of Montreal, have been incorporated with a total capital stock of $90,000 for the purpose of dealing in electrical machinery, construction work, etc.

The General Brass Works, Toronto, purpose to deal in brass goods, share capital $50,000. Directors are James William Baby, Alfred William Ecclestone and Alexander Watt, all of Hamilton, Ont.

The Sherwin-Williams Co., of Ohio, have been registered in Ontario to carry on the business in paints, oils and colors. The company have appointed A. J. Russell Snow, of Toronto, solicitor, to be their attorney.

J. Flett & Co., Wiarton, capital $25,000, implement and hardware business. Provisional directors, James Flett, Wiarton; and W. R. P. Parker, G. McP. Clark, F. B. Matthews, and J. L. Hynes, all of Toronto.

Canadian Swensons, Lindsay, share capital $1,600, for the purpose of dealing in all kinds of machinery, etc. Directors to be Henry Rustad of Cresco, Iowa, Isaac Ernest Weldon and William Henry Kennedy of Lindsay, Ont.

Standard Power Gas Construction Corporation, of Toronto, capital $100,000. Provisional directors: Frank Ford, Britton Osler, G. C. Loreys, J. F. H. McCarthy, and J. M. Ewing, all of the McCarthy, Osler firm, Toronto.

Boiler Flue Cleaner and Supply Co., of Toronto, capital $100,000; to deal in engines, boilers, etc. Provisional directors: A. C. Buell, Buffalo; C. E. Adams, London, Ont.; T. H. Wark and D. W. Livingstone, Toronto, and Eric Wilson, Hamilton.

The Canada Fence Company, London, Ont., purpose to manufacture and sell wire fences and wire goods, share capital to be $40,000. Directors are William Samuel Bryers Barkwell, James Emsley Sutton of London, and Donald McLachlan of Glencoe.

The Canadian Tap and Die Co., Galt, purpose to carry on business connected with screw-cutting tools, machinery, etc. Share capital to be $40,000, directors William Morley Preston, Galt, and Franklin Edward Snow and Frank Orrin Wells of Greenfield, Mass.

Pre-payment Electric Meter Co., Limited, Peterboro, capital $100,000; to manufacture electrical supplies, etc. Provisional directors: A. Hollingshead, Wm. Hamilton, J. H. Larmouth, J. H. McClellan, Alfred Parker, and A. J. McClellan, all of Peterboro.

B. F. Sturtevant Company, of Massachusetts, have been registered in Ontario to manufacture and sell steam heaters, fans and other engines, electric and other motors, etc. The company have appointed John Colon Grant, of Toronto, manager, to be their attorney.

E. C. Atkins & Co. of Indiana have been authorized to manufacture, sell and repair saws, machinery, tools and other hardware articles in the Province of Ontario with a sure capital of $40,000. Charles D. Ten Eyck is to be the company's attorney.

The Oshawa Heat, Light and Power Co., Toronto, purpose to manufacture and supply gas and other artificial light for heating and cooking, etc. Share capital to be $100,000, and the directors are Peter Ryan and Robert James Goudy of Toronto and Loftus Edwin Dancey of Goderich.

Coleman Cobalt Company, Limited, of Toronto, have been incorporated with a share capital of $250,000 for the purpose of carrying on in all their branches the operations of mining and milling. The directors are Albert Robert Moore, Hamilton Bender Wills and John Jennings, all of the city of Toronto.

The Hart Corundum Wheel Company and the Canadian Corundum Company of Hamilton have amalgamated under the name of the Canadian Hart Corundum Wheel Company, with a capital stock of $75,000. The applicants for the charter were the following: Charles D. Warren,

Toronto; C. S. Wilcox, George F. Webb, Harley E. Sherk, directors, and Andrew S. Devine and F. H. Whitton.

The Canadian Tool Company, Limited, of Woodstock, Ont., have been incorporated with a share capital of $200,000 with the right to manufacture, buy, sell and deal in tools, machinery, engines, and other articles made from iron, steel and other metals. Directors are to be: Edwin George Law and Joseph Stickney, both of Toronto, Arthur James Downing, James Jackson Terry and Theophilus Leroy Wilson of Woodstock.

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MACHINERY BUYERS' DIRECTORY.

Readers of CANADIAN MACHINERY are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principa firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

Abrasive Materials.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Air Brakes.
Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Air Receivers.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Arbor Presses
Niles-Bement-Pond Co., New York.

Augers.
Chicago Pneumatic Tool Co., Chicago.

Axle Cutter.
A. B. Jardine & Co., Hespeler, Ont.

Axle Setter and Straightener
A. B. Jardine & Co., Hespeler, Ont.

Babbit Metal.
Canada Metal Co., Toronto.

Barrels, Tumbling.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.
Niles-Bement-Pond Co., New York.

Batteries, Storage.
Chicago Pneumatic Tool Co., Chicago.

Bell Ringers.
Chicago Pneumatic Tool Co., Chicago.

Belting, Chain
Waterous Engine Works Co., Brantford.

Belting, Leather.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal
Williams & Wilson, Montreal

Belting, Cotton.
Dominion Belting Co., Hamilton.
Sadler & Haworth, Montreal.

Belting Supplies.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.
Canada Machinery Co., Sarnia
Chicago Pneumatic Tool Co., Chicago.
John Bertram & Sons Co., Dundas, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York

Benders, Tire.
Boynton & Plummer, Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.

Blowers.
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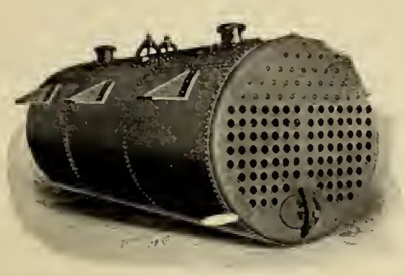

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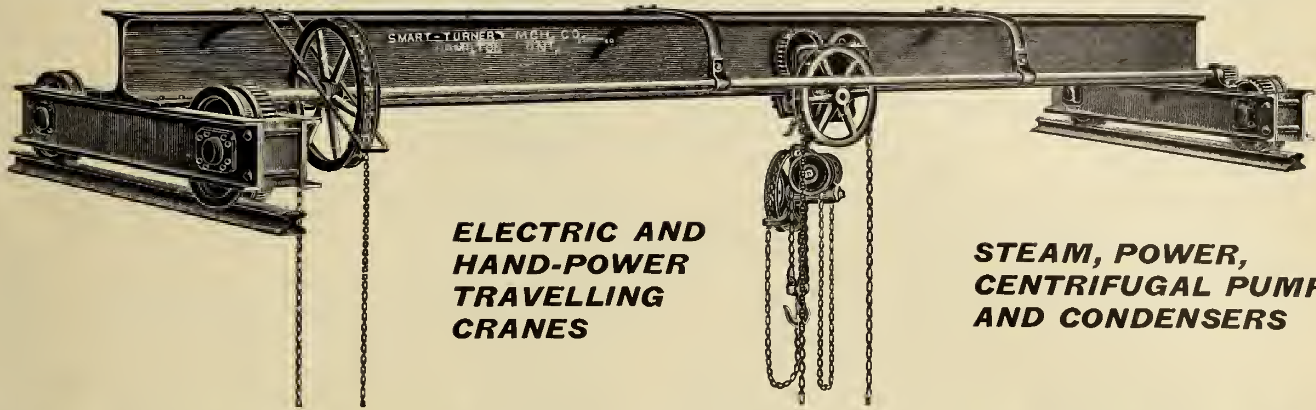

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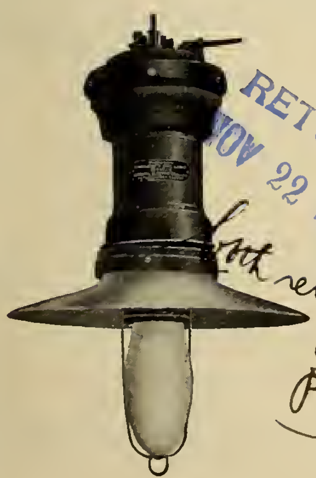

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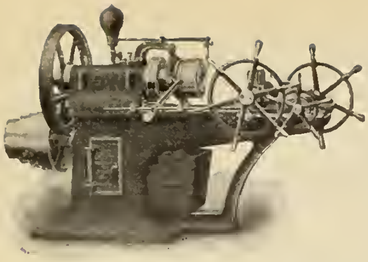

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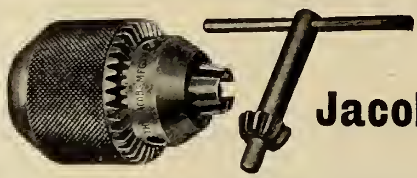

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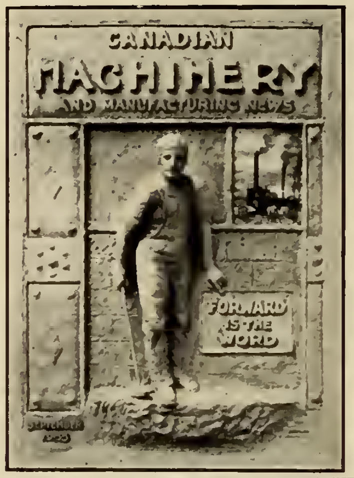

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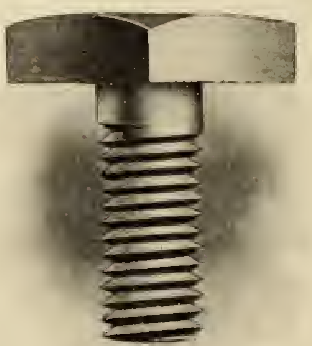

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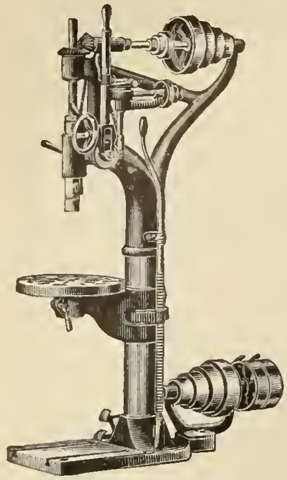

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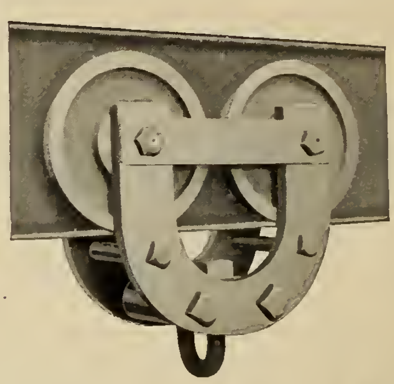

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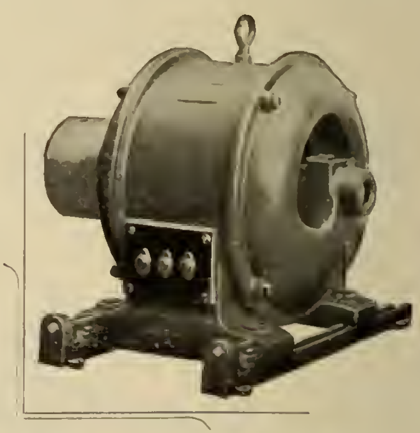

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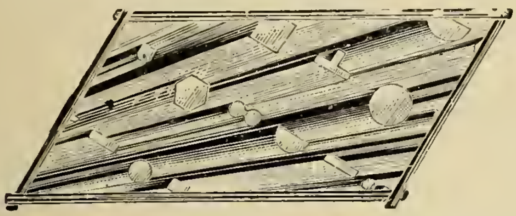

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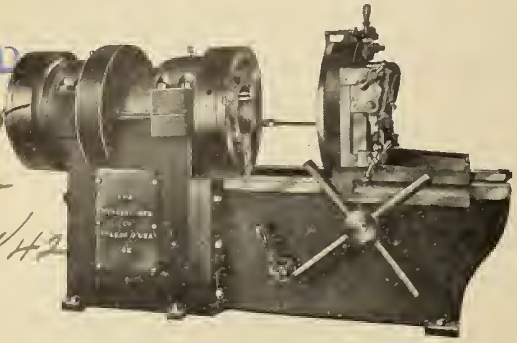

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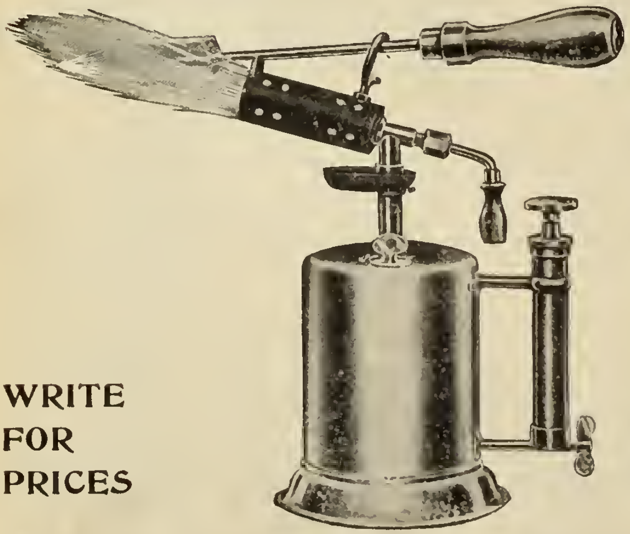

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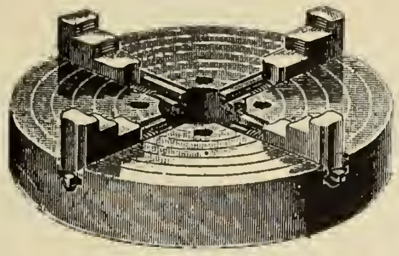

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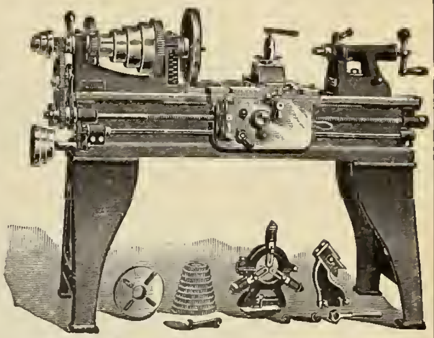

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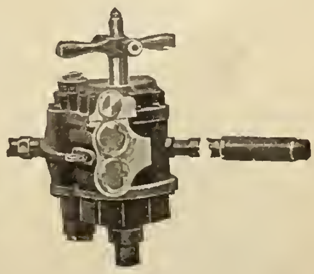

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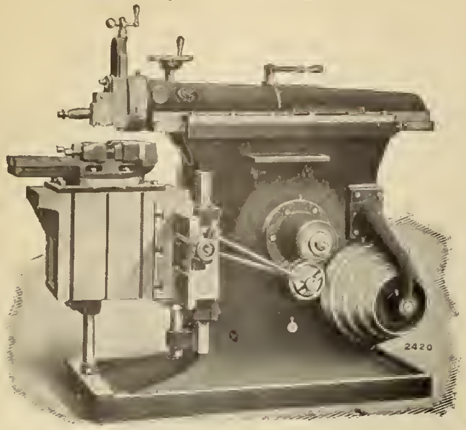

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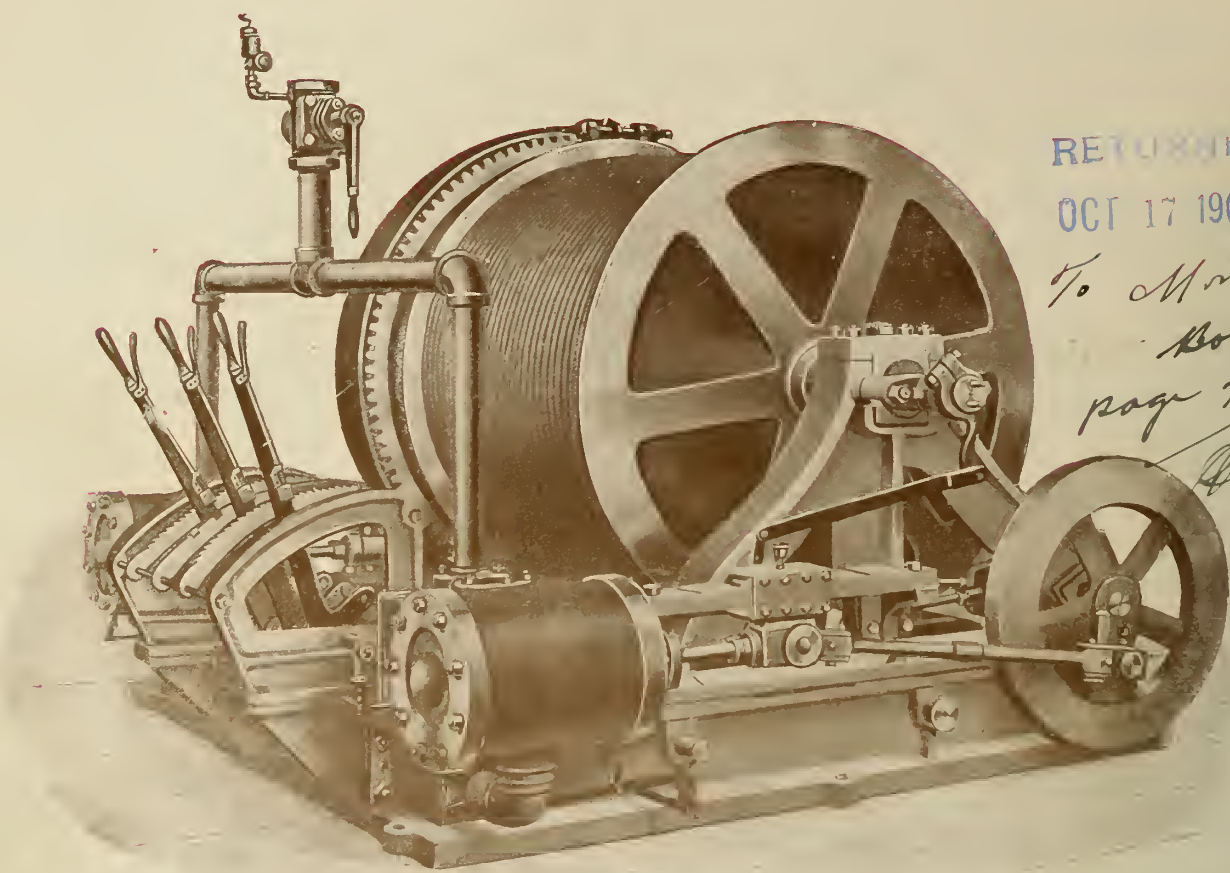

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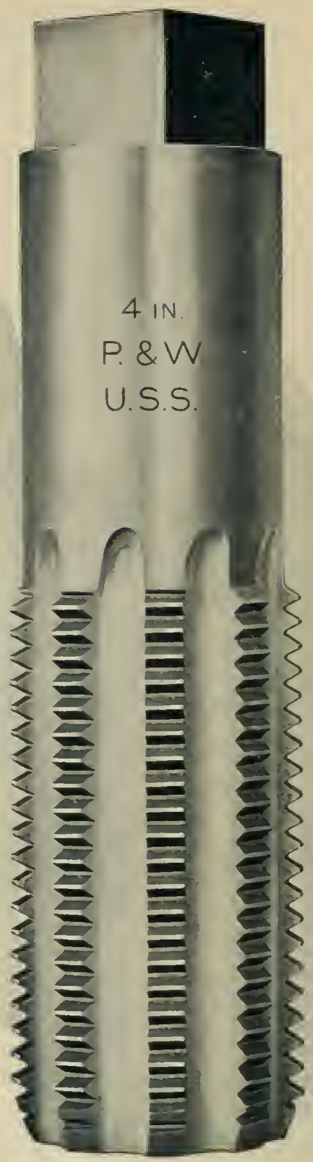

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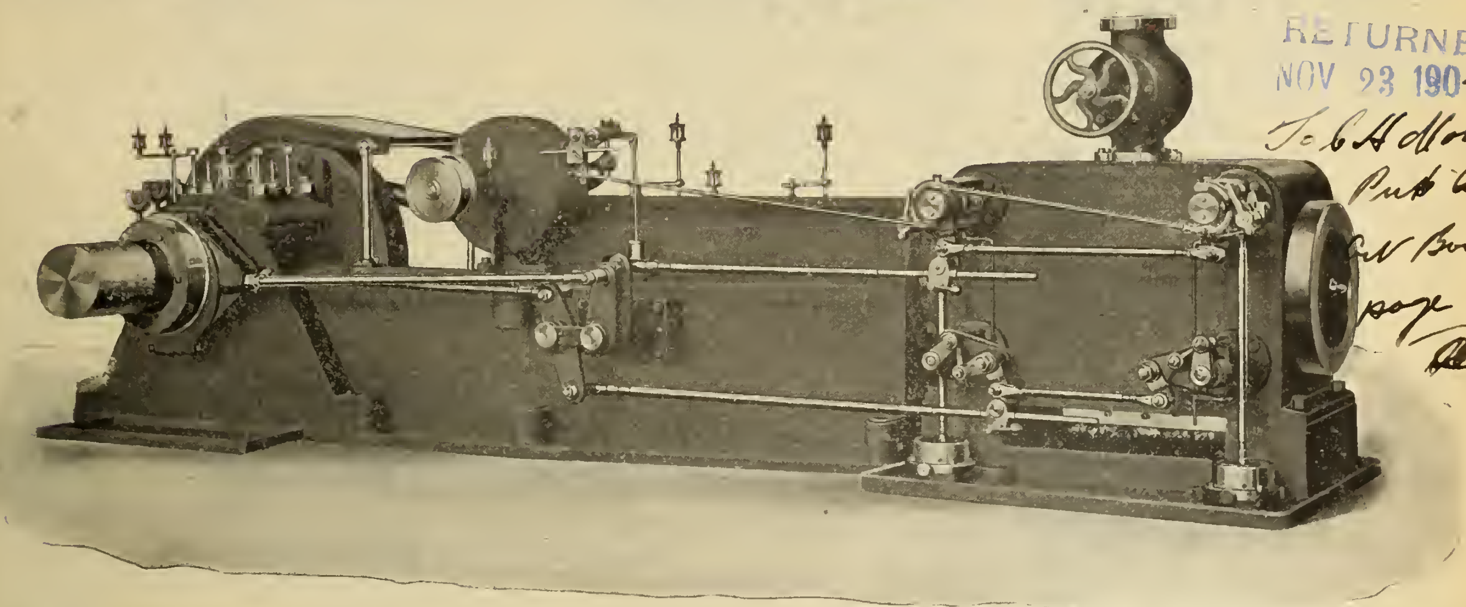

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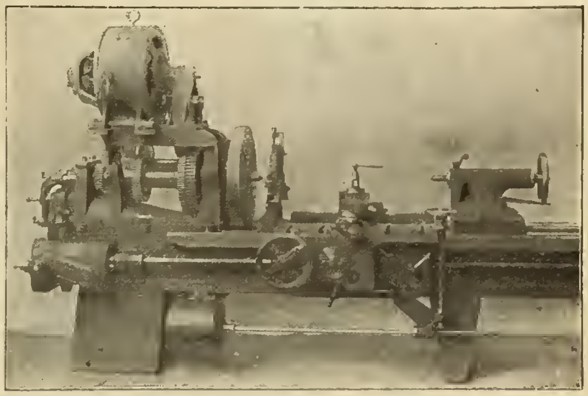

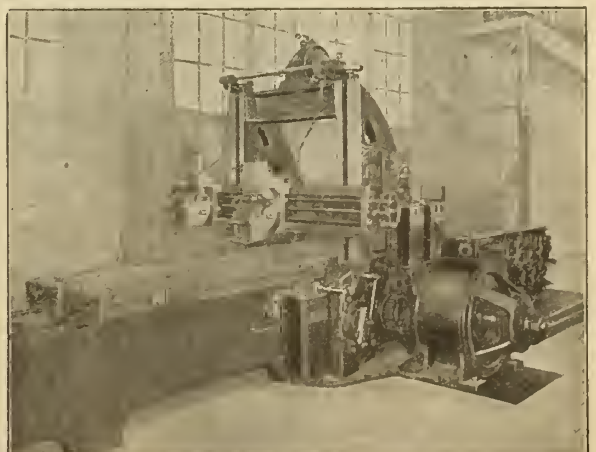

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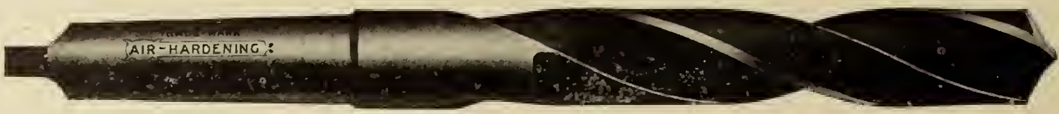

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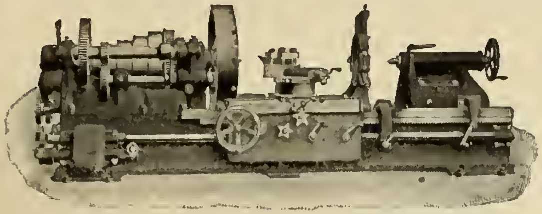

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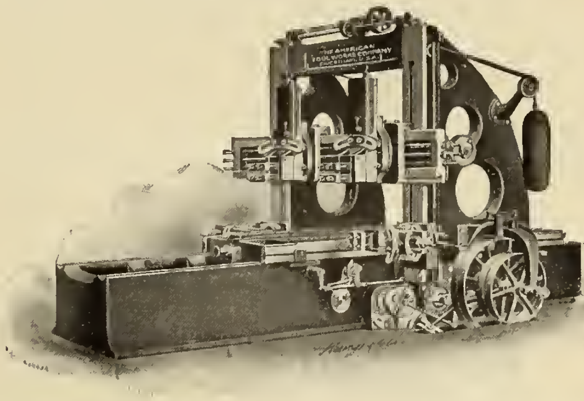

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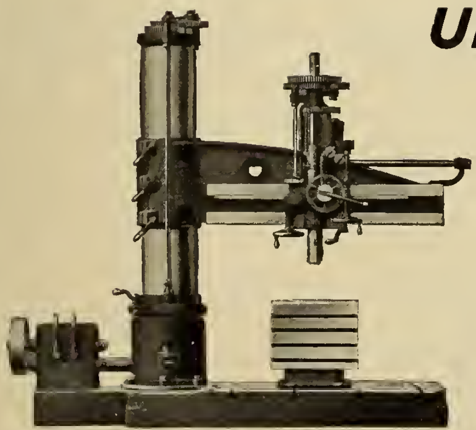

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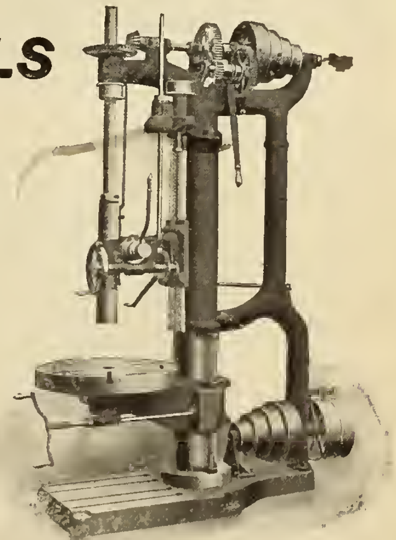

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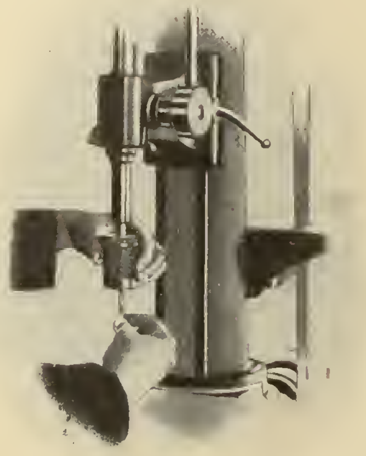

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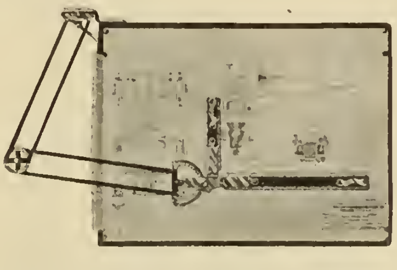

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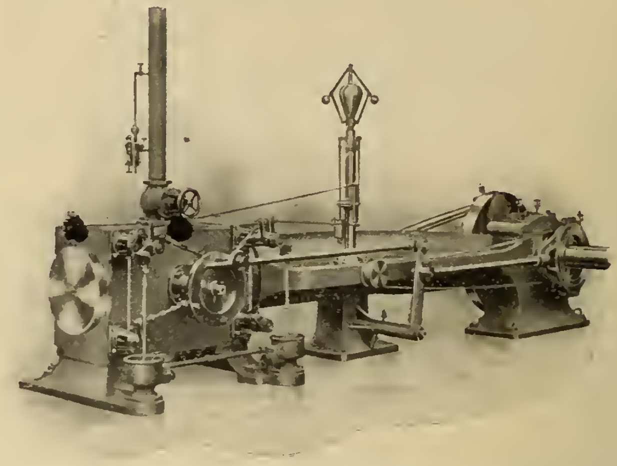

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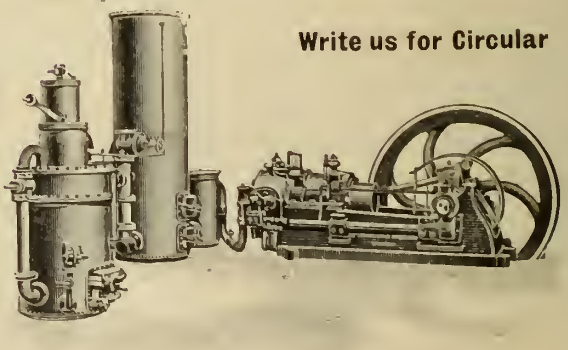

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48" x 13' 6" " 52 3" "
48" x 13' 6" " 42 3" "
44" x 13' 6" " 43 3" "
44" x 14' 6" " 40 3" "
44" x 11' 9" " 42 3" "
40" x 12' " 21 3" "
38" x 12' " 36 3" "
32" x 11' " 22 3" "

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48" x 10' 6" with 152 2" tubes.
36" x 84" " 60 2½" "
36" x 72" " 60 2" "
30" x 72" " 42 2" "
26" x 60" " 37 2" "
24" x 48" " 32 2" "
24" x 50" " 31 2" "
20" x 40" " 41 2" "
20" x 36" " 16 2" " NEW.
19" x 44" " 13 2" " NEW.
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Automatic Engines

24" x 48" Stearns Corliss.
17" x 42" Right Hand Brown.
16" x 36" NEW Laurie Corliss.
13" x 30" Left Hand Wheelock.
11" x 24" " " Corliss.
12" x 10" Westinghouse Junor.
12" and 20" x 12" Erie Ball Tandem compound.
11" and 19" x 15" McIntosh & Seymour Tandem compound.
11" x 10" Peerless, self-oiling.
11" x 15" NEW No. 9 Jewel.
10" x 15" " " 8 "
10" x 12" No. 7 Jewel
8" x 10" " 5 "
8" and 13" x 18" Tandem compound.
6½" x 8" Armington & Sims.
5" x 7" " "

Other Steam Engines

12" x 12" Laurie, NEW, horizontal.
11" x 12" " " "
1?" x 10" Leonard C. C. "
9" x 10" " " "
8¾" x 9" horizontal.
8" x 8" Laurie, NEW, horizontal.
7" x 12" horizontal.
7½" x 9" Dutton, NEW, horizontal.
7" x 7" NEW, upright.
6" x 9" horizontal.
6" x 7½" " centre crank.
6" x 8" upright.
6" x 6" " NEW.
5" x 6" horizontal.
5" x 7½" upright, centre crank.
Also several small engines down to ¾ h.p., horizontal and upright.

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8" and 16" x 12" NEW, fore and aft.
7" and 14" x 10" " " "
7½" and 14" x 12" steeple compound.
9" x 12" Doty.
9" x 12" NEW, complete.
7½" x 9" NEW, Dutton.
7½" x 8" " "
6" x 6" all complete.
5" x 7½" " "
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48" x 9" Upright Sub. Tube Boiler.
30" x 84" " " " "
36 H. P. Horizontal Self-Cont. Boiler.
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25 H. P. Fire Box Boiler.
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7" x 10" Cornell " "
74" x 11" Clyde Boiler.
48" x 72" Fitzgibbon Boiler.
4 H. P. Acme Engine and Boiler.

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One 50 H. P. New Ohio.
One 25 H. P. Toronto Junction.
One 20 H. P. New Ohio.
One 15 H. P. Pierce.
Two 14 H. P. New Ohio.
One 14 H. P. Ohio on wheels.
One 12 H. P. Brantford.
Two 10 H. P. Haggas.
Three 8 H. P. Ohio, NEW.
One 7 H. P. Triton-Marine.
Two 6 H. P. Ohio.
One 6 H. P. Toronto Junction.
One 5 H. P. New Adams Marine.
Four 4 H. P. New Ohio.
One 3½ H. P. Triton-Marine.
Two 3 H. P. Upright.
One 2½ H. P. New Brantford.
One 2½ H. P. Goldie & McCulloch.
Four 1½ H. P. NEW and Second Hand.

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3 8" x 5" x 12" NEW Duplex.
5 6" x 4" x 7" " "
6 5¼" x 3½" x 6" " "
18 4½" x 2¾" x 4" " "
8 3" x 2" x 3" " "
8" x 5" x 12" Single Acting.
7" x 4" x 6" " "
6½" x 4½" x 7" " "
6" x 4" x 6" " "
5" x 3½" x 7" " "
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3¾" x 8" pedestal plunger pump.
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50 " " " "
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40 " " Patterson "
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1 " 32" x 18' "
1 30" x 14" Heavy bed.
1 NEW 28" x 18' London.
1 28" x 18' Dundas.
1 NEW 26" x 16', also 10' bed.
8 " 24" from 10' to 20 ft.
9 " 18" " 6' to 16 ft.
1 24" x 8' Dundas.
1 18" x 6' in good order.
6 NEW 16" from 6' to 10 ft.
2 16" x 6' rebuilt.
10 NEW 15" from 6' to 10 ft.
4 " 14" 6 and 8 ft.
3 " 13" 6 " 8 "
1 14" x 6' Dundas.
3 NEW 12" x 6 ft.
1 " 11" x 60" Barnes.
1 " 9" x 57" "

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NEW 26" x 42" x 14' Gap.
" 24" x 40" x 12' "
" 30" x 46" x 12' "
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18" x 8' Davis Turrett Lathe.
16" x 6' Fox Lathe.
NEW 15" x 6' Fox Lathe.
11" x 48' Speed Lathe.
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1 " 16" Single Geared "
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3 Small Hand Planers.

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2 " 72" Universal Radials.
1 6 Spindle Multiple.
1 4 " "
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1 " 28" "
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1 NEW 24" London.
1 24" in good shape.
6 NEW 20" Barnes, B. G
3 " 20" " Lever Feed.
2 " 14" Sensitive, Pedestal.
2 " 14" " Bench.
2 11" Plain, Upright.
1 NEW 12" Barnes Friction.
2 " 10" Friction.
1 " Fox High Speed Drill.
6 Sensitive Bench Drills, NEW
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8 Blacksmiths' Hand Drills.
6 " " and Power Drills.

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1 No. 45 Power Press, NEW.
2 " 21 " " "
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2 " 19 " " "
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No. 2 Cady Press.
Heavy Bliss Stamping Press.
NEW No. 1, Challenge Soap Press.
Power Draw Press.
NEW Erie 400 lb. Steam Hammer.
" 150 lb. Drop Hammer.
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60 lb. Palmer Spring "
NEW 50 lb. Foot Power "
4¾" x 10" Steam Hammer.
Several smaller ones.

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5 " 15" " "
14" throat, Bertram make.
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" " 4, " Double.
" " 2, " Single.
" " 1, " "
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Large Power Alligator Shear.

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30" x 6" x 16", Stevens Un. "
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5 Iron Frame Key-seaters.
NEW 2" Cutting-off Machine.
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24" Surface Planer, rebuilt.
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1 12" rebuilt.
1 10" "
1 6" "
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6" Sash Sticker.

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2 " " 1 Clement, Variety.
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Dimension Saw Table.
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Egan Double Cut-off Saw.
NEW Champion Cut-off Saw.
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4 Wood Frame Machines.
2 NEW Swing Saws.
2 Rebuilt " "

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36" Pedestal in good order.
NEW 32" Pedestal.
" 30" Bracket.
30" Bracket, rebuilt.
NEW 26" Pedestal.

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Rebuilt Band Re-Saw, 54".
40" Galt Circular Re-Saw.
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Swing Shingle Machines.
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30" " " Perfection.
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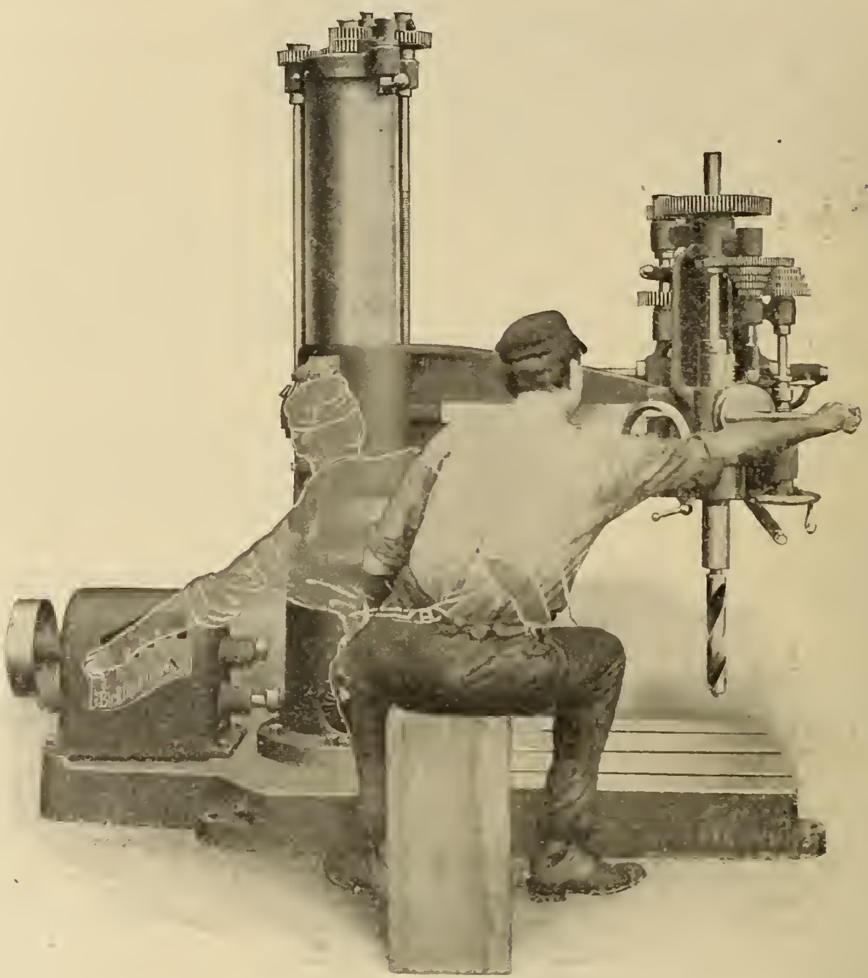

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1	400	157	39.2	7		
2	74	57	77	8		
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Average, heavy machine work	....	....	62.3	Average, light machine work	....	....

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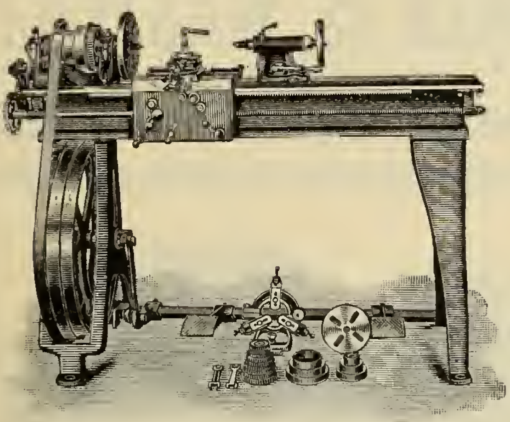

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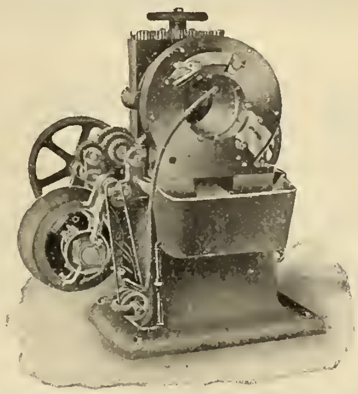

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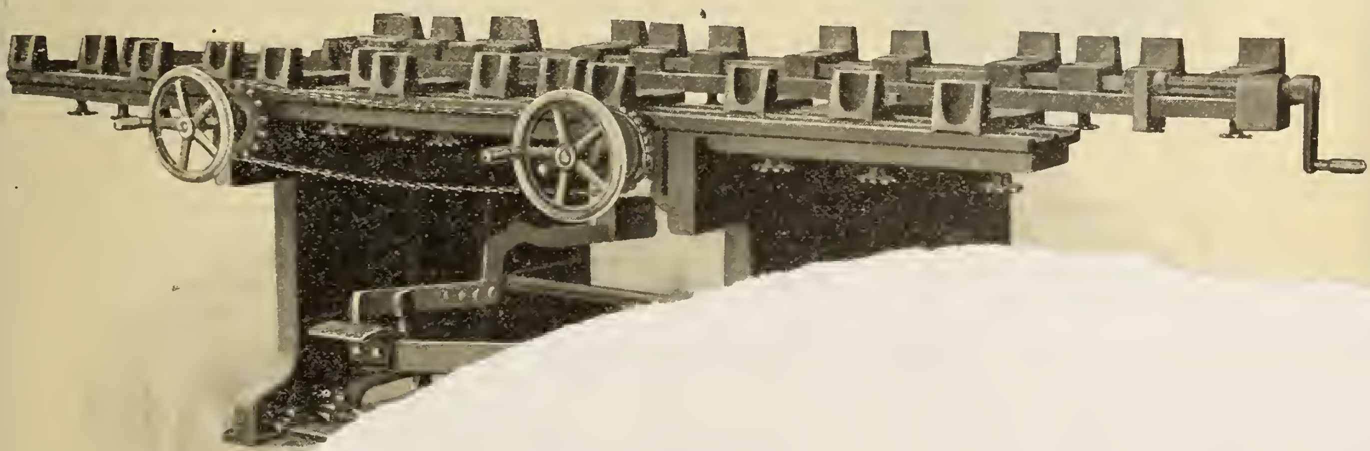


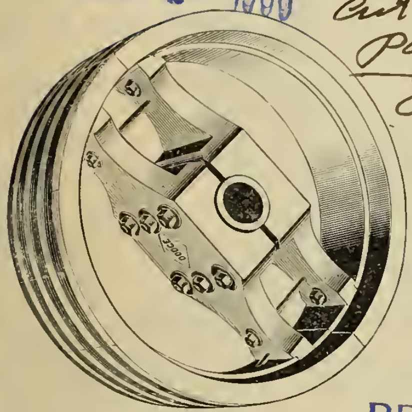
Our '

Special f
Other f

CLA'

Dodge

To owner
Cut Book 5-1
Page 6
A. Q.



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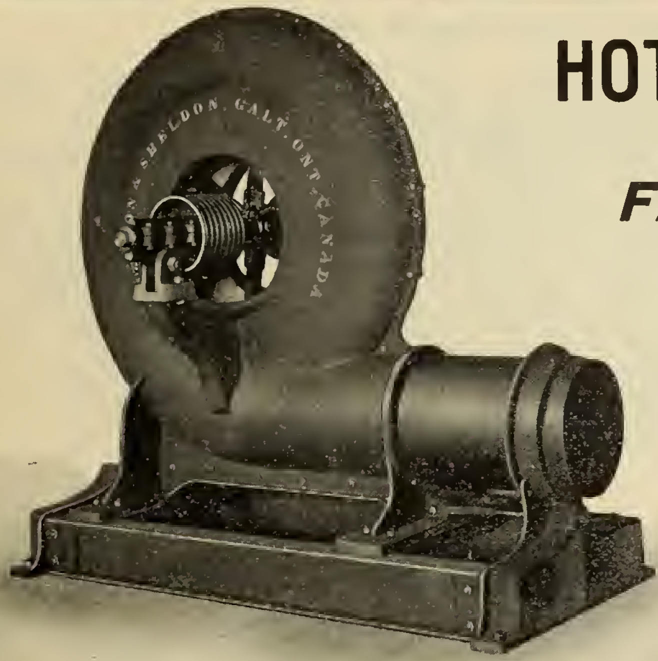

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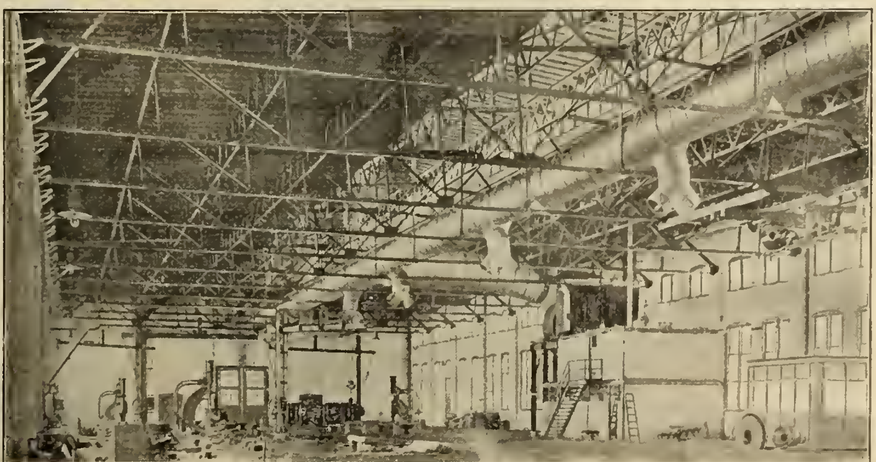

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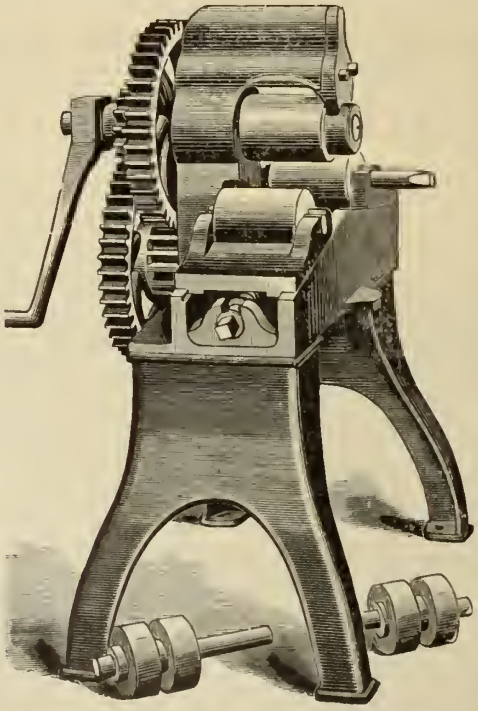

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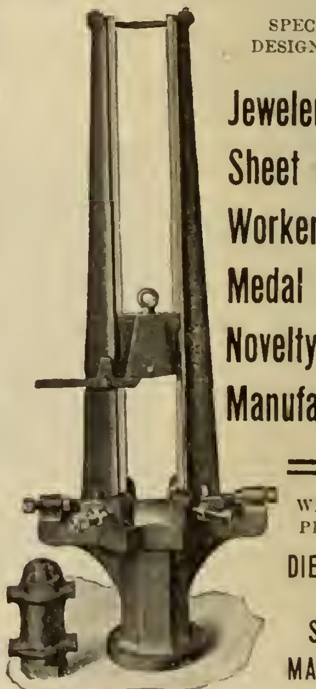

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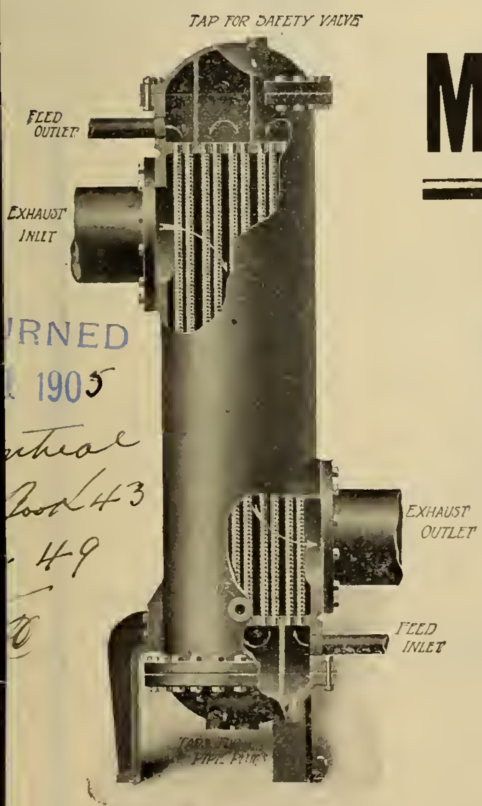

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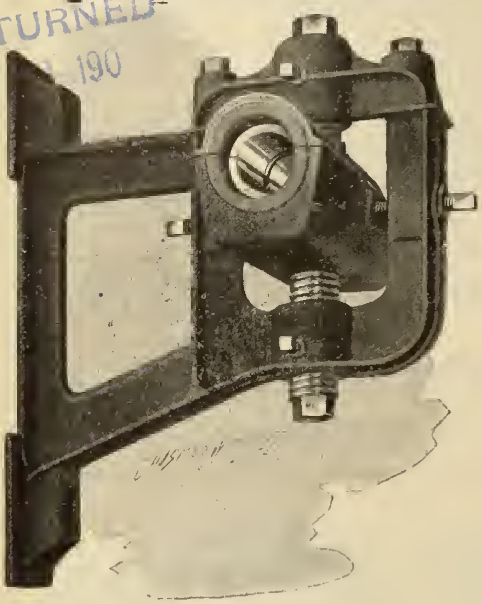

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The bottom of bearing is made flat, so that it will not upset when out of frame.

The construction of hanger is such that bearing is absolutely self adjusting. This most valuable feature, which insures perfect alignment with shaft, is only obtainable by the use of large cast iron plungers. It cannot be secured where bearing is supported by four set screws.

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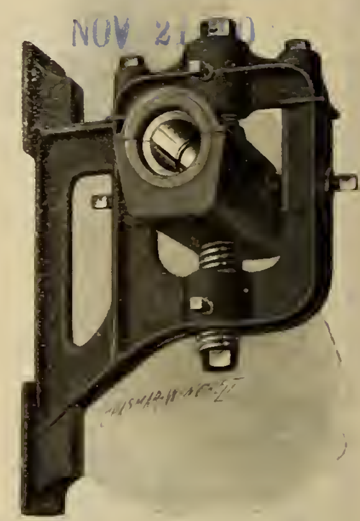

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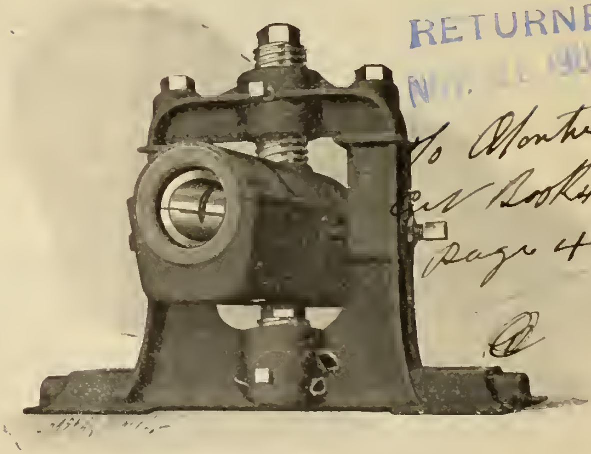

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Modern Canadian Manufacturing Plants.

ARTICLE IX.—Matthews Bros., Limited, New Picture Moulding Factory, Toronto.

BROCKTON, just west of Toronto, is rapidly becoming built up with a fine class of modern factory buildings that not only give the place an air of industrial activity but add materially to the general appearance of the district owing to their newness and general attractive design. This spot seems to have become popular as a manufacturing centre very recently, as almost without exception the structures where manufacturing is now carried on have been erected within the past two years. The fact that splendid transportation facilities are to be had at this point is no doubt one of the chief factors tending towards the decision of manufacturers to locate here. Both G. T. R. and C.P.R. sidings are available.

Factory Building.

On the northwest side of the Dundas street bridges the first factory is that of Matthews Bros., where one hundred and twenty-five car loads of lumber are made each year into picture moulding of all classes and of such a range that the completed frames sell all the way from fifteen cents to seventy-five dollars. This factory is less than a year old and for general appearance and stability compares favorably with any of the others. It is a solid brick structure, the different departments being separated from each other by solid brick walls and fire doors. These departments include wood working, picture moulding, finishing, storage and office. It is three stories high, the arrangement being such that the transportation of material is reduced to a minimum. They are connected by a 17-foot elevator which runs in a separate elevator shaft as a greater precaution against fire and of a length suitable to take a load of 16-foot moulding. The power plant is contained within the main building while the drying kilns are situated apart as well as the great stacks of raw lumber piled in the yards ready for use.

Ground Floor.

Starting at the northwest corner where the power house is situated is found a well equipped isolated plant which supplies power, heat and light to the entire establishment. The boilers are of Goldie & McCulloch make, having a capacity of about two hundred h.p. operating at 80 pounds pressure. A Wheelock steam engine of 150 h.p. runs the shafting in every department, a notable feature of this engine being the immense fly wheel sixteen feet in diameter. In the power house is also situated a 15 k.w. dynamo built by McLachlan, Joy Electric Co., Toronto. Thus another element of safety is assured by using electric lights for illumination. The switchboard for the dynamo consists of a pretty piece of marble mounted with the necessary instruments and having controller underneath.

Adjoining this is the wood-working department where the rough lumber is shaped into the different patterns desired. This room is probably the busiest in the building as it contains more machinery and receives all the rough lumber from the kilns or yard without, necessitating heavier handling than in any other department. Several Goldie & McCulloch and McGregor-Gourlay moulding machines are kept in constant operation. Following the latest practice in wood-working establishments, to further the general cleanliness and for the comfort of the workmen as well as economy in handling, exhaust pipes are attached to each machine leading to a sixteen-inch main through which by means of a Sturtevant exhaust fan all shavings, dust and small blocks are conveyed direct to the boiler. This room is forty-eight by one hundred and twenty-two feet and is well filled with the necessary machinery.

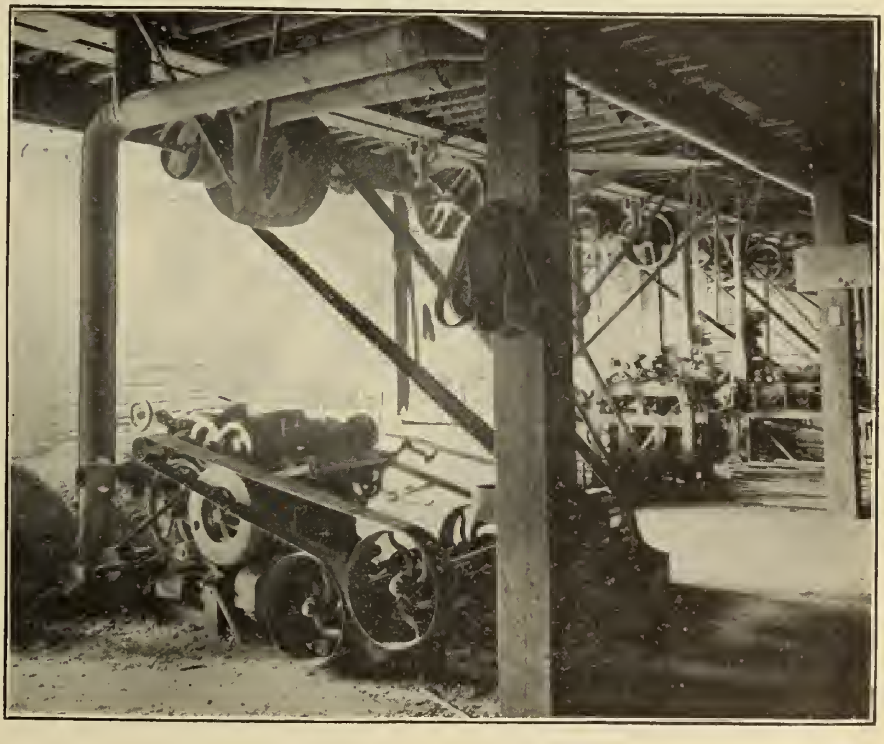


Fig. 1.—Wood Working Department.

A Notable Machine.

One of the most striking machines in this room is the sand paper machine, which is of large capacity, being capable of handling the work of a large planing mill. It will take in mouldings, casings, base, etc., up to twelve inches in width, finishing up to eight inches without cutting the stock. This machine is equipped with thirty-two brushes mounted on revolving heads and the pressure of these forces the sand paper, which is mounted on spools and cut in strips at the end, against the moulding to be smoothed and conforms it to the shape going through. It runs at three different speeds and will finish work as well as the best hand finished output at the rate of from 20 to 40 feet a minute.

Whiting and Composition Room.

When the moulding has been shaped in the "sticker" or moulding machine it

goes to the whiting and composition room, which is parallel to the wood-working room and separated from it by

Fig. 2.—Whiting Machine in Operation.

a solid brick wall. Here, except in the case of the oak and other natural wood finished mouldings, it receives several coats of whiting. Like the operations already mentioned this also is done by machinery, a special whiting machine manufactured by W. Zoeller, Chicago, being used for the purpose. Thus, in using the latest and best improvements in machinery Matthews Bros., Limited, are able to manufacture on a much more economical basis than would otherwise be possible. The machine consists of a table along which the moulding passes and above which are mounted a series of feed rollers in two sets, upper and lower. The lower rollers are made of iron, the upper ones of rubber discs, held between flanges. At the end of the platform rests the whiting box proper, which adjusts itself in every direction to suit the moulding while the latter is passing through the machine. It might be mentioned in passing that one hundred and fifty tons of whiting are used here in one year. The last run on this machine consisted of 12,240 feet of 3-inch moulding.

After receiving four coats of whiting the moulding is taken to the composition machine where the composition forming the pattern on the moulding is applied. This composition for ornamenting the moulding consists of whiting, resin, oil and glue mixed in a dough-mixing machine in the same way that flour dough is mixed and kneaded in like manner to the household article.

Fig. 3—Operator Doing Special Work on Frame.

Costly Rollers.

The machine for pressing the composition is of simple design, the most striking feature being the rollers. Each contains a different pattern. As the work is passed through under the revolving brass roller the operator feeds the composition by hand. It is pressed firmly to the wood by the pressure of the revolving pattern wheel and from its nature adheres to the wood. Each of the rollers costs a large amount of money, and in a vault opening from the stock room situated at the end of the two departments just described the writer was shown a number of these brass rollers which were valued at ten thousand dollars. For hand-made moulding the composition is run through the machine in the same manner, on boards and then cut into lengths and placed as desired.

Storage.

The third department on the ground floor is for storage. Here are stored the oak and other natural wood raw mouldings. They are stacked on end in movable racks, thus taking up a minimum of space. This room runs east and west, being situated at the south end of the factory, while the other departments lie north and south.

Second Floor.

Immediately over the rough wood-working room is situated the sawing, joining and fancy wood-working department. Here are to be found mitre saws, shapers, jig saws, choppers and box makers' saws. In this room the frames are put together. Many of them are

joined before being gilded or stained and finished, while others are made from the finished moulding, which after the composition has dried are given their finishing touches in the gilding and lacquer rooms. Great skill is attained by the operators on these frames. At the present time one order for 7,000 frames of 3-inch oak is being put through.

Gilding and Lacquering.

Going to the top floor, where a large amount of the stock is sent instead of going to the fitting room, is found an elaborate department for gilding, burnishing and lacquering the moulding. The genuine gilt frame is overlaid with silver leaf by a skilled operator, after which it is gilded, burnished and lacquered, whereupon it retains its brilliance and lustre a lifetime. Other mouldings receive a coat of bronze and lacquer, the latter belonging to a cheaper grade.

This same floor contains a large storage room where the white stock as well as some finished stock is placed.

Finishing the Frames.

Returning to the second floor one finds the fitting room, lying adjacent to the sawing, joining and fancy wood-working department. Here the pictures are fitted. The glass is placed in the frame, as well as the picture mat and backing. In many cases a good deal of hand work is done on the frame, such as corner pieces and other designs, and this work is done here. One of the features of economy in this department is the manufacture of their own cardboard for matting. It is made from wood pulp and cover paper, backed up with white paper, effecting a saving of over 40 per cent. of duty as this is not made in other places in Canada.

Mention might have been made before this of the polishing department, which is next the finishing room, and in which all the moulding is varnished and polished and the veneer frames stained and finished.

While this completes the actual manufacture of the moulding and frame there is yet another department, the shipping room, which is found to be an interesting spot. Here large stacks of frames are piled ready for shiument. An overhead traveling crane carries them out over the lorrie whence they are lowered to the ground.

Other Features.

This brief description does scant justice to the very complete plant of Matthews Bros., Limited, as it is modern in every detail and in keeping with the progressive spirit of the time. A Rochester time clock has been installed and here 100 men register their time morning, noon and evening. The fire-fighting apparatus is complete in every detail, consisting of stand pipes on every floor, barrels and chemical engines. Taking it all through this plant of Matthews Bros., Limited, with its modern equipment is worthy of some notice and occupies a position among the modern Canadian manufacturing plants.

BOOK REVIEWS.

Organizing a Factory. An analysis of the elements in factory organization, a presentation of the fundamental principles of factory management and a description of the methods to be used in every department of factory operation, by C. E. Woods, E.E., M.E.; Chicago and New York, The System Co.

Herein is published a rearrangement of the series of articles written for "System" by the author, revised and collected in such a manner as to make the complete work and lead the reader on from step to step to give him a comprehensive understanding of the questions involved. In reading this book the fact cannot help being borne upon one of the importance attached not only to the best system of organizing but the most up-to-date method of operating an industrial concern at the present time. Besides dealing with the actual organization the relation between the executive heads and the employes is dealt with. Chapters devoted to accounting, of expenses and cost and analysis of different methods of paying labor are of particular value. The latest and best methods in modern practice are dealt with. The last chapter deals with the reduction of labor costs, something every factory organization should keep well in view. The book shows that the factory should be run on the authority of facts and figures which present the best returns and employ the most systematic management.

Hand Book for Cement Users. The third edition, revised and enlarged, by Chas. Carl Brown, M. Am. Soc. C.E., published by the Municipal Engineering Co., 369 pages.

When this book was first published in 1901 it met with a very favorable response from all interested in the cement industry, covering the ground as it did in such a thorough manner, and containing useful information that had up till that time not been placed in concise and comprehensive form. Successive editions of this valuable volume have, however, strengthened its position as an authority on the subject. It is thoroughly educative and goes into the subject in considerable detail. The writer of the book is the editor of Municipal Engineering, a live and up-to-date monthly dealing with the problems affecting municipalities, in connection with which the question of using cement has of recent years come to be such a live issue. The language in the book is simple and clear, and the subject is dealt with from the manufacture of the cement to its test, and from that leading on to its many applications, and the result of recent developments in this important industry. Anyone connected in any way with building, whether of structure or foundation or municipal roadways or sidewalks, can peruse this volume with pleasure and profit, and keep it as well for a reference to consult at any time.

Fig. 4.—Shipping Department.

Plans for the new street car sheds of the Montreal Street Railway Co. have just been completed by Messrs. Marchand and Haskell, architects. The contract for construction of this building has been given to the Canadian White Co., Limited.

An Interesting New Works

AN increasing business for years past, during which time their apparatus has gone to all quarters of the globe, necessitated the building of a new plant by the B. F. Sturtevant Co. After some consideration the best combination of advantages seemed to present itself in a lot of 20 acres in the town of Hyde Park, Mass., already well known as the home of such industries as the Becker-Brainard Milling Machine Co., American Machine Tool Co., and the new shops of the N.Y.,N. H. & H.R.R. Here was presented a population of particularly skilled workmen, which could readily be supplemented by present employes of the company, the new location being only six miles from their old plant.

The site having been selected, most careful consideration was given to the size and character of the buildings; the head of each department was consulted, his recommendations reduced to writing, and frequent conferences held as to the requirements of the individual departments. With these data at hand the individual and aggregate areas were determined and the plans started with the idea of providing a total floor space slightly more than double that of the old plant. The aggregate floor area of the finished buildings is actually over nine acres, or nearly two and one-half times that of the Jamaica Plain plant. Employment is already given to about 1,300 hands, although the plant will accommodate nearly 2,000. A special train which runs directly into the yard naturally assists in transportation.

Testing Electric Fans.

Buildings.

The disposition of the buildings was determined by the provision to be made for growth. The adopted arrangement provides for a group of buildings parallel to the railroad tracks, with accommodations for spur tracks between buildings, their entrance at the ends of certain buildings, and an opportunity for growth of all important structures by extension in length. The type of construction is somewhat composite in its character, consisting of steel interior columns and main steel girders, with heavy brick walls, wood timbered floors and plank roofs. In the case of the one-storey foundry, the roof is supported by steel trusses, in the other buildings open timbering with wooden columns in the upper floor is employed.

The main floors in the machine, fan and erecting shops are of tar concrete, upon which 3-inch hemlock is bedded in liquid pitch and toe-nailed together. The upper floors are carried upon hard pine beams on 4-ft. centres spanning the spaces between the steel-girders, which

Corner of Testing Plate, with Electric Switchboard of the Same.

follow a unit system of 20 ft. on centres throughout the buildings. The machine shop gallery floors, which are designed for 250 lbs. load per square foot, are of 2½ in. plank: other upper floors are 2 in. plank for 200 lbs. per

Bins in Stores Room.

square foot. Maple top flooring is used in all cases. All roofs are of 3 in. plank with tar and gravel top.

Power Equipment.

The entire plant is electrically driven and lighted at 220 volts from a central power house containing at present one 100 k.w. and one 250 k.w. Sturtevant generating set; the power plant engines run condensing. The exhaust steam derived from engines under test upon the plate in the testing building is utilized head. The boilers are equipped with Sturtevant fuel economizers for heating the feed water. The power house is placed sufficiently far from the ends of the buildings to permit of ample extension of each, and near enough to the water supply to reduce to a minimum the expense of conveying condensing and other water. Steam, electricity and compressed air are transmitted to the individual buildings through a concrete tunnel and a supplementary system of covered trenches.

Foundry and Pattern Shop.

Foundations for many of the buildings were put in during the late Fall of 1901. Actual work of construction upon the foundry and pattern buildings began in July, 1902, and the first heat was poured on December 29, 1902.

The pattern building provides at one end a two-storey portion 80 feet square for carpenters, flask makers and metal pattern makers on the first floor, and for regular patternmakers upon the second floor. The balanee of the building, which is devoted to pattern storage, is of about the same ground area, and is provided with intermediate floors, making four in all, separated from the other portion of the building by double fire walls and automatic fire-closing doors. The close proximity of this building to the foundry facilitates rapid intercourse.

ways of 24 inch gauge bedded in concrete, which form runways between the moulding floors. Two craneways run lengthwise of the building through the greater part of its length, and the

Interior of Grinding and Polishing Room.

tracks extend beneath the crosswise traveling crane in the cleaning room at the end of the building.

The brass foundry is located in one corner, a wash and locker room in the adjacent corner, and the core room between the two. Storage for supplies is provided upon one side adjacent to the railroad switch. From the bins thus provided, the iron and fuel charges already weighed are carried directly to the charging floor.

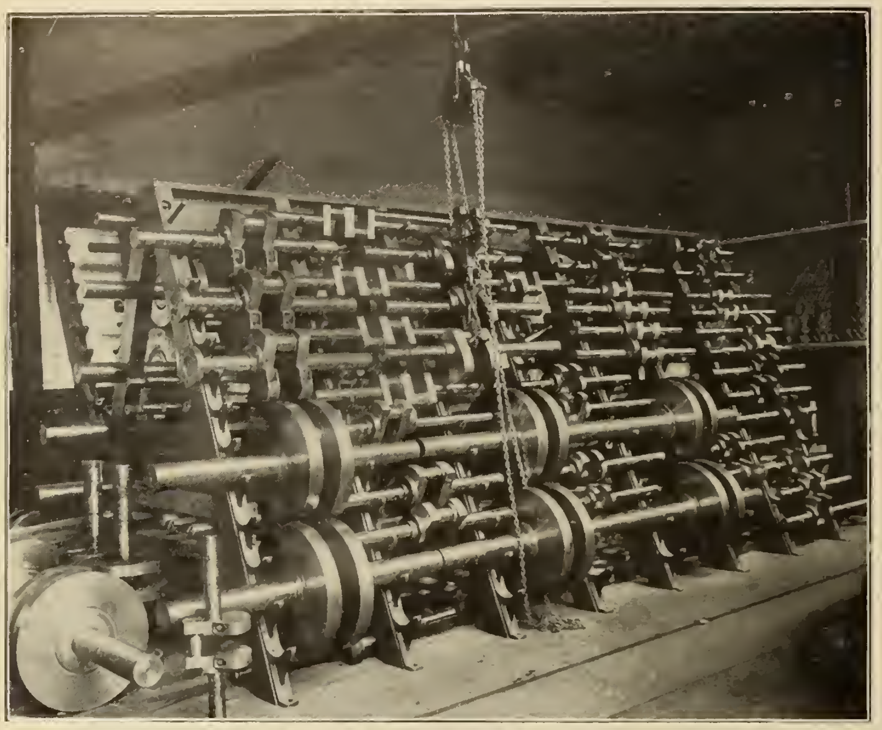
Interior of Machine Shop, Looking Toward Testing Building.

for heating, supplementary live steam being admitted at reduced pressure as may be required. Waste exhaust is discharged through a Sturtevant exhaust

The foundry, 170 x 350 feet in dimension, is designed for the distribution of molten iron upon a floor track system, and is equipped with narrow gauge rail-

From the foundry the castings pass to the rear of either the machine shop or the fan shop. The former is of the familiar gallery type, 500 feet long,

with wings 40 feet wide, and central craneway of the same width designed for crane of 20 ton capacity, making a total width of 120 feet. The lighting, which is remarkably effective, is secured principally by a series of sawtooth skylights running crosswise of the roof glass facing due north.



Storage of Crank Shafts in Machine Shop.

The present crane of only 10 tons capacity serves the entire floor, and finally deposits the substantially complete engine or generator upon a transfer car which passes through to the testing building where a 15 ton crane picks up the machine, drops it upon the testing plate, and subsequently carries it forward to the steam railway track which passes through the end of the building and provides space for the loading of two cars at a time. The upper floor of this building (which measures 80 ft. by 240 ft., and is three storeys high) together with portions of the adjoining buildings, is devoted to the electrical department and provided with individual small traveling cranes.

Transportation Facilities.

Both steam and industrial railway tracks enter the machine shop at the end farthest removed from the erecting shop. Generally speaking, large castings and forgings pass in at this end and are transported by the crane, while smaller articles are brought in through the numerous side entrances and are handled by hoists or by manual labor. Industrial tracks cross the building at the centre and both ends. The centre cross track is in the direct line of transit from foundry to forge and fan shops.

Upon the ground floor, in the corner nearest the erecting shop, is located the general store rooms and the office of the stores keeper. This room, measuring 40 by 100 ft., contains all general stores, brass and malleable castings and the like, and is the repository for completed parts of engines between the time of their completion and their requisition for assembling.

Tools are arranged for the progress of the work from the open end of the shop toward the finished stores and erecting shop. Until such time as an independent department is provided for the manufacture of economizers, equipment for this work is provided near the entrance to the machine shop. Otherwise the grouping of machines is in accordance with the general scheme. In the open craneway are already located two Detrick & Harvey open-side planers (one a 60 in. and the other a 72 in), a 6 ft. and 7 ft. Baush radial drill, a Beaman & Smith horizontal boring mill with 60 in. swing, and 48 in. Johnson lathe. Immediately beneath one of the side galleries is a line of planers, including a Cincinnati 60 in. by 48 in high, a group of radial drills, and several horizontal boring mills; all served by traveling cranes on a continuous runway. Beyond these are the large vertical and planer type milling machines.

Under opposite gallery are arranged the large vertical boring mills, including a 76 in. Bullard, the large upright drills, and a complement of chucking crank shaft and shafting lathes.

The second floor is served by four elevators and an equal number of stairways, one at each end and two at the centre. The galleries are connected at the ends by bridges; the grinding and polishing room (equipped with a Sturtevant exhaust fan, hoods and piping), being located at the end adjacent to the erecting shop. Close beside it on the same floor is the brass finishing department and the office of the superintendent of the machine department. In the opposite gallery, in the most accessible position, are the tool making and tool storage rooms. An enclosed bridge connects with the second floor of the fan shop.

Piping Up Heater Sections in Fan Building.

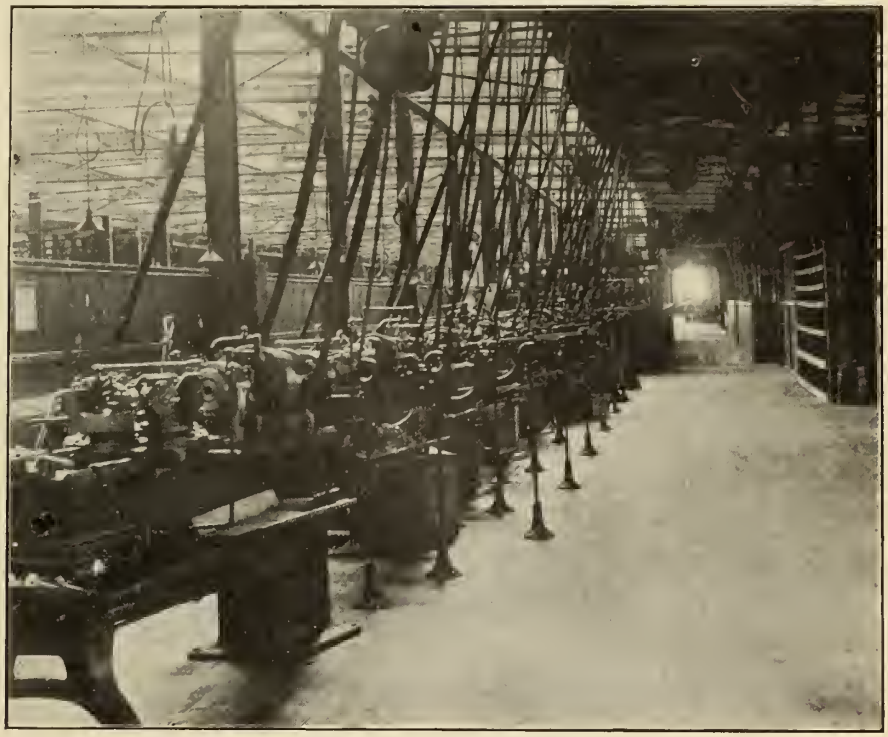
Machine tools are grouped by types, and so far as possible arranged for progressive operations. Space is left for additions in supplementary parallel rows. Large machines are driven by direct-attached Sturtevant motors. Twenty horse-power motors suspended overhead are so located as to drive the small tools in groups of suitable size through individual lengths of line shaft.

The building devoted to the manufacturing of fans, heaters, etc., is 80 feet in width, of the same length as the machine shop, and three storeys in height, of typical mill construction, provided with all conveniences for handling material, and arranged so that goods can be received at, and shipments made, from numerous points along one side, while other supplies are brought in from the court between it and the machine shop.

One-half of the length of the fan shop is served by a 5-ton traveling crane, the floor to floor height throughout the area being 32 feet to provide for the construction of large steel plate fans for ventilation, mechanical draft, and the like. Here, also, are built the heater jackets, some of them large enough for a Summer cottage. In the adjoining space on the first floor are installed large shears and brakes for cutting and folding plates up to 120 in. in length, and rolls for ½-in. plates 120 in. wide. Pneumatic punches, rivetters and chippers are extensively used in this building. Plate iron is completely stored on edge in diagonal alcoves in the storage shed alongside the fan shop, which has a capacity for nearly a thousand tons.

Immediately above in the gallery is a supplementary equipment of smaller plate working tools, punches, etc. Upon this floor are built all of the steel plate fan casings for planing mill exhausters, small steam, electric and pulley fans.

Midlength of the first floor is the packing and shipping department, near the large five-ton elevator which serves all floors. The other end of this floor is devoted solely to the manufacturing of heater sections for the Sturtevant steam hot blast apparatus. Millions of feet of one inch pipe are annually cut up by the numerous machines and made into sections by screwing into cast iron bases. The sections thus made are tested by hydraulic pressure to 180 pounds per square inch.



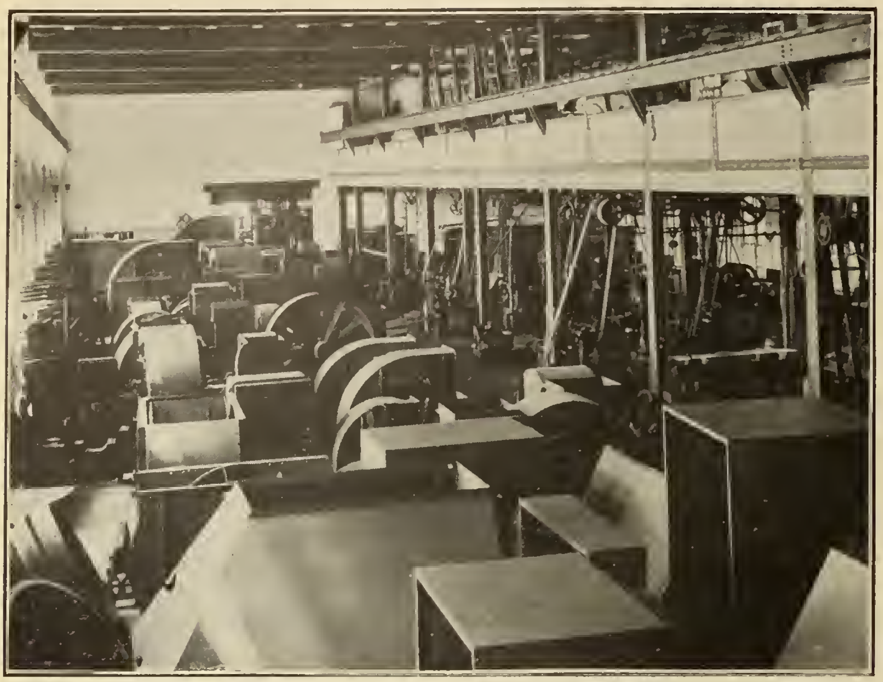
Automatic Screw Machines in Gallery of Machine Shop.

Round Jib Crane, Machine Shop.

Some Departments.

Immediately above, upon the second floor, the cast iron fans are built. Here, also, are constructed forges, countershafts, etc. All fans, except the largest, are given a rigid inspection test. Nearly one-half of the third floor is devoted to galvanized iron work, the making of air distributing pipes and shapes, the manufacture of exhaust heads, etc. Upon the same floor are set up fan wheels ranging all the way from 6 inches to 20 feet in diameter. The balance of this floor is devoted to the punching and commutator division of the electrical department, which is located upon the adjoining third floor of the erecting building. In one end of the latter space occupied by this department is the baking room for armatures, etc. This measures 40 feet square, is entirely fire-proof, and contains two steam-heated ovens. At the other end of the building is the special storeroom for electrical supplies. The balance of this floor and of the intermediate floor below is devoted to winding, assembling, testing, etc. Fans are here equipped with motors and run under test conditions. Generators for direct connection are carried down to the first floor of the same building, where they are attached to their respective engine and continuously run upon the test plate. The balance of the first floor is given to the assembling of engines and to the packing, storage and shipment of these

machines. The testing plate, measuring about 30 ft. by 60 ft., is completely equipped with steam and electrical



Erecting Floor for Fans and Heater Jackets in Fan Building.

connections. Engines may be run condensing or non-condensing and efficiency tests conducted. This very complete equipment has proved invaluable in conducting the rigid tests demanded by the U. S. Navy Department upon the engines, generating sets, engine and motor-driven fans, which this company has furnished to the Government in large numbers.

Smith Shop.

The smith shop, 40 ft. by 100 ft., serves both fan and machine shop buildings with equal facility, while the wash house and locker room, also measuring 40 ft. by 100 ft., and two stories in height, is so located as to reduce to a minimum the distance to be traversed by the individual workman. A separate building, with concrete basement, is provided for the storage of oil, paint, naptha, and the like.

The smith shop is equipped with a full outfit of Strutevant forges, with blower for blast and exhaust fan for removing smoke. The equipment also includes a Dupont power hammer and an 1,100-lb. Bement, Miles & Co. steam hammer, together with heavy shears for cutting angles and tees, of which thousands of tons are used annually in the construction of fans and heaters. In the open court room near the smith shop and between the fan and machine shops, is stored under lock and key all of the high-grade bar iron and steel, and upon a piling floor and in open racks are kept all of the structural shapes required.

Features of Construction.

The standard first floor height in the main building is 17 feet; that of the second and third storeys is 15 feet. The windows are large and numerous. Ribbed glass is used in all but the lower sashes. All structural steel, window frames, racks, and bins, and the walls up to a height of 5 ft., are painted a rich green. The balance of wall and ceilings is covered with white, cold water paint.

The entire industrial equipment was designed and constructed by the B. F. Sturtevant Co., in the effort to secure something better than the market afforded. The outfit comprises the industrial railway system, including the platform, coal, charging and dump cars, ladle trucks, truck ladles and turntables; the general factory equipment, consisting of cast iron bench legs, electrical hoists, wash-sinks, shelf-brackets for pattern storage, etc., the manhole and catch basin covers and frames, trench cover plates, hangers, and the like.

Heating and Ventilation.

All of the buildings are heated and ventilated by the Sturtevant system. In the machine shop the hot air pipes are hidden beneath the second floor wall benches and deliver most of the air downward to the first floor. The fan and erecting shops are supplied through an underground duct which delivers the hot air to external vertical flues upon one side of the building, which in the case of the fan shop are located 40 ft. on centres and discharge the air across the building above head level.

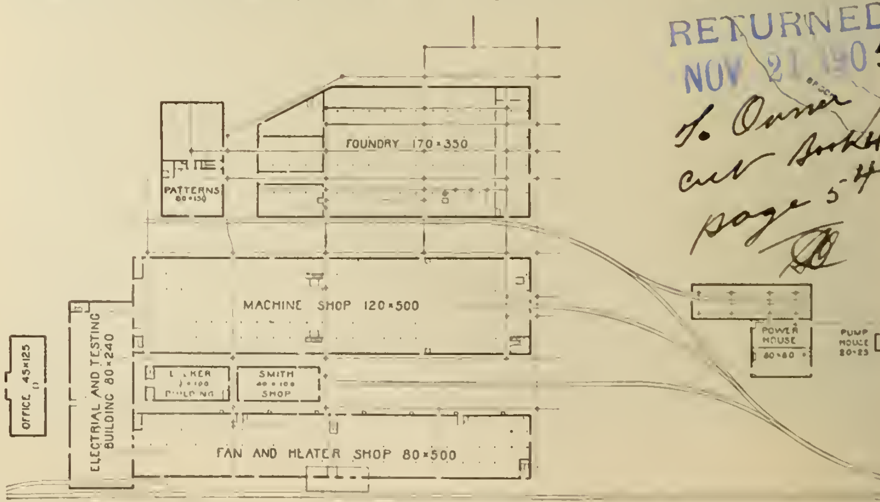
Office.

The office is a model structure of its kind and serves as headquarters for the entire business. It contains the correspondence, accounting, designing and drafting offices, the production department, the advertising bureau and a printing office and lunch room in the basement. It is four storeys in height.

GRAND TRUNK PACIFIC TENDERS.

It is now announced that the successful tender for the two hundred and ten mile section of the Grand Trunk Pacific between Fort William and Lake Superior Junction involved the sum of about $3,000,000.

The successful tenderers are Foley Bros. & Larson, who will, it is stated, sublet about two-thirds of the work to other contractors, probably stipulating that they purchase their supplies and implements from their firm. As their profit on these will be in the neighborhood of forty per cent., their total returns should be very considerable.



General Plan of Works.

Reviews of the Month

OPINIONS AND STUDIES WORTH NOTING

NEW DESIGNS OF FRICTION CLUTCHES.

FRICTION clutches as hitherto constructed, which transmit power by means of spiral springs, only permit, when but a single spring is employed, of the rotation of the shaft in one direction. In the designs illustrated only

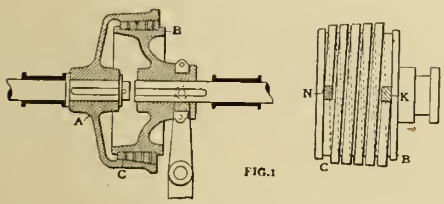


FIG. 1

one spring is employed, but this is so arranged that the shaft may be rotated in both directions.

In the form shown in Fig. 1, the clutch member A is turned conically internally, while the clutch member B is of cylindrical form. The spiral spring C bearing up on the periphery of the cylindrical clutch member B is conical upon its outer periphery, but is not rigidly connected to the member B. The two ends of the spiral spring rest against the stops K N formed on the clutch member B in such a manner that it is able to slide or become compressed or extended by the amount of play afforded by the stops. Between the inner face of the spiral spring and the outer cylindrical periphery of the clutch member B there is but very slight play. The clutch member B is displaceably mounted upon the shaft, but rotates with this latter, while the part A is mounted fast upon the shaft. By displacing the clutch member B in the left-hand direction the spiral spring comes into contact with the inner face of A, and friction is set up between the former and the clutch member A, so that both the spiral spring and the plate B are driven, the latter by means of the stops K N, according to the direction of rotation of A.

In the form shown in Fig 2 both the clutch member A and B are cylindrically formed. Both parts are mounted fast upon their shaft ends to which they are keyed. In the inoperative condition of the clutch, the spiral spring C which is employed bears upon the plate B, so that there is an interval between the spiral spring and the member A of the clutch. As in the construction illustrated in Fig. 1, in this instance also the spiral spring is not brought into direct contact with the clutch member B, but by the intermediary of the stops M and R. The stops are not, however, as in the first case, made in one piece with the plate B, but are rotatably mounted upon the hub of this latter. By driving the wedge S between the stops M and R these latter extend the spiral spring in such a manner that it bears upon the member A, whereby friction is caused and the member A, drives the spiral spring so long (according to the direction of rotation) as the stops M and R reach the edges of the recesses X Y of the member B, whereby this latter is also driven. Upon the

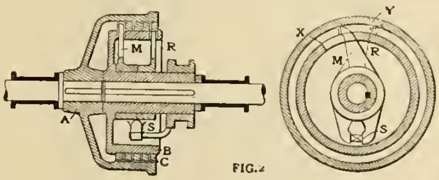


FIG. 2

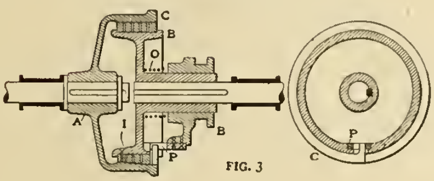


FIG. 3

withdrawal of the wedge the friction ceases, so that the clutch is released. The coupling may also be effected in the present case by the spiral spring bearing when the wedge is out on the member A, while after the wedge has been driven in it bears upon the member B, so that the movements of the wedge are reversed for coupling and uncoupling.

In the form illustrated in Fig. 3 the clutch member B is displaceably mounted on the shaft, but rotates with this latter. The spiral spring C bears upon the plate B, and it may be extended either in the manner previously described or as shown in Fig. 3. In the latter case one extremity of the spiral is fixed by means of rivets I to the clutch member B, while its other extremity is in contact with a wedge by means of which it may be extended. In this form the power can only be transmitted in one direction of rotation. Between the plate B and the hub member B, to which the wedge P is attached a spring O is arranged. By the movement of the hub member B, for example, in a left-hand direction the members B and B1 will be brought together until the spiral spring C and the member A come into contact with their conical friction faces, whereupon the member B is incapable of further displacement. After the wedge has quite extended the spirals complete coupling takes place. The purpose of this arrangement is to reduce the power required for producing the coupling to a minimum. In the form of clutch illustrated in Fig. 2 the spirals must be extended to such an extent that the interval between the spring and the member A is completely filled, and only after this can the power necessary to induce friction be employed, while in this latter arrangement the spiral spring comes into contact with the member A even before the extension of the spirals is terminated.—The Mechanical Engineer.

METALLIC PACKINGS.

METALLIC packings for the rods and stems of steam engines, compressors and the like, are intended not only to fulfil all the purposes for which fibrous packings are used, but also to give increased durability. Being made of metal, it is reasonable to suppose that the amount of wear between the

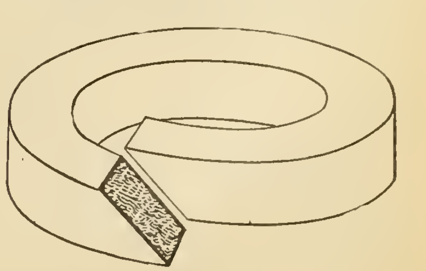


Fig. 1.

packing and the rod will be considerably less than in the case of fibrous packing. This conclusion is borne out in practice, since a rod which is properly packed with a metallic packing will give a much long-

er service, before repacking, than if it were supplied with the ordinary fibrous kind.

In Fig. 1 is shown a form of metallic ring packing, made up in rings of the

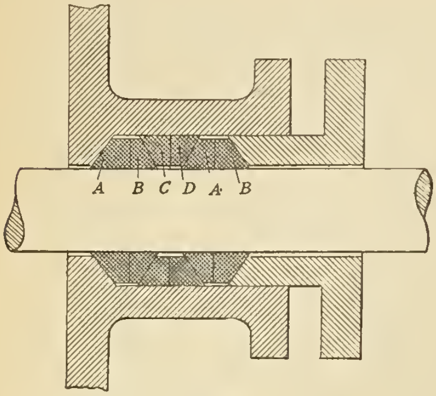


Fig. 2.

proper size to fit the rod and stuffing box. These rings are placed one on top of the other until sufficient to fill the stuffing-box properly, after which the gland is tightened, as in the case of fibrous ring packings.

In Fig 2 is shown a form of wedge packing. Each of the rings A, B, C and D is made in two pieces, molded to the wedge form as shown, with the flat face and one beveled on each. The flat faces of each pair of adjacent rings are placed together, so that when a slight pressure is brought to bear by the gland, the rings slip along their beveled faces, the rings A and B being forced against the rod and C and D against the walls of the stuffing-box. The rings are composed of bearing metal and graphite, and can be made to fit any form of stuffing-box.

A simple form of metallic packing is shown in Fig. 3. It is composed of rings made in halves, which are placed around

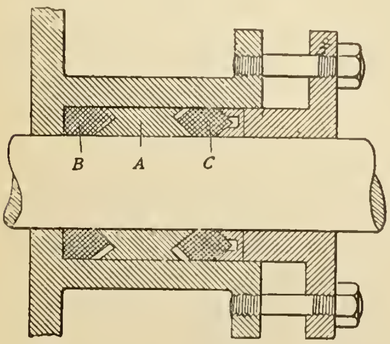


Fig. 3.

the rod in such a way as to break joints. The central ring A is forced against the rod, and the end rings B and C against the wall of the box. Thus, the babbitt ring A makes the joint. The spaces between and outside the rings permit the collection of condensation and lubricants, which are relied upon to keep the packing cool. This is a floating packing, also; that is, it follows the rod when the latter has a slight lateral movement due to imperfect alignment.

The great majority of metallic packings, instead of being either plastic or elastic, are of the solid type, like that illustrated in Fig 4. This figure shows the packing applied to a rod without making use of the old stuffing-box and gland, which is the manner in which many metallic packings must be applied. The reason is that the construction of the packing is such as to prevent its going into the stuffing-box.

The packing consists of three pairs of rings at A, B and C, each pair contained in grooves in a casing. These grooves are just wide enough to allow the two rings to fit in snugly side by side, and not too tightly to prevent lateral motion. The

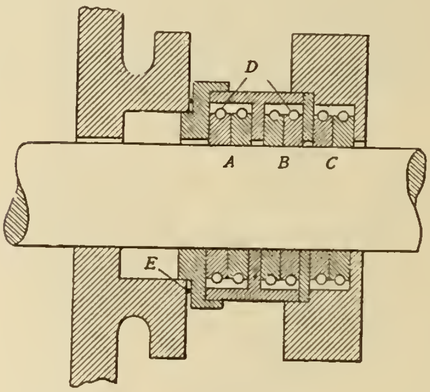
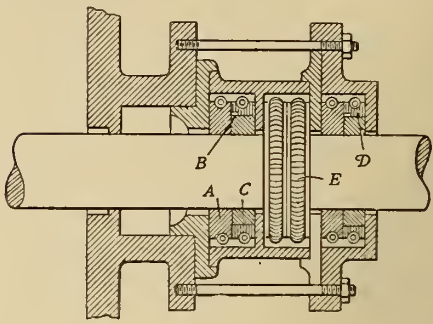


Fig. 4.

packing rings thus are floating, that is, moving with the rod, so that if the rod is not centred exactly, or if it is slightly bent, the rings are free to follow it in its lateral movement in the box.

The packing illustrated in Fig. 5 differs in some of its details from that just described, although its general arrangement is much the same since it has six rings, in three pairs, placed in casing compartments. The casing, however, is not a single piece, but is made up of several separate parts. The packing rings, also, are different. In each pair there is a broad ring and a narrow ring. The broad ring, shown at A, is of three segments, held together by the usual outside spring. But one segment carries the dowel pin B, which fits into the opening between two of the segments of the adjacent narrow ring C.

Some novel features enter into the construction of the packing shown in Fig. 6. The usual three-part casing is used, containing three pairs of packing rings, which are free to move sidewise in their several compartments. Each one of the rings is divided into three pieces,



No. 5.

which do not meet one another when placed around the rod, but are held together by a split ring, A, against which press flat springs.

THE WORLD'S IRON.

THE amount of iron ore still available is very great, doubtless many times, perhaps twenty-fold, as great as has been wont to use. Yet we see already that in the continent of Europe the fields long in service are beginning to be exhausted. Great Britain has practically consumed its store which a century ago seemed ample. Practically all the supply for its furnaces is now imported. The supply from the Mediterranean, that promised to be inexhaustible cannot endure for many decades to come. The same is the condition of the ore districts of Central Europe; at the rate of the increasing demands they are not likely to meet the demands of a hundred years. There remain extensive deposits of rich ores in the Scandinavian

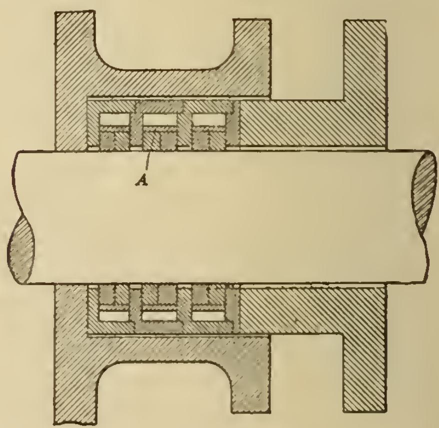


Fig 6.

peninsula, and in fields in the confines of Belgium and France which have hardly begun to be drawn upon, yet it is evident that at anything like the present rate of increase in the consumption of

metallic iron the European sources of supply are not likely to endure for a century.

The best placed field for the production of iron in North America or save that in Northern China, in the world, is in the central section of the Mississippi Valley, mainly between the great river and the Appalachian system of mountains and northwards beyond the great lakes to the headwaters of the streams flowing into Hudson Bay, the physical conditions on the whole being favorable for the cheap production of the metal and its ready transportation to the principal markets. It is a question, however, if the store will supply the demands of the future. — International Quarterly.

HORSE-POWER VS. MAN-POWER.

THE measurement of a horse's power of work, first ascertained by Watt, the inventor of the steam engine, was founded upon the basis that the average brewery horse was capable of doing work equal to that required to raise 330 lb. of weight 100 ft. in one minute, or 33,000 lb. one foot in one minute. This estimate, however, was for one minute; it would not be possible for a horse to perform this amount of work continuously for eight consecutive hours. One horse could exhaust 12 men in a single day, for where a strong man could perhaps pull half of 330 lb. to a height of 100 ft. in two minutes, he probably could not repeat the operation more than a few times. A man's power is about one-tenth of a horse's power. That is, where a horse could pull 330 lb. to a height of 100 ft., one minute, and then slack up and repeat the operation, for eight hours, thus pulling four hours, and slacking up four hours, it would require ten strong men to perform the same amount in that length of time. When man put horses to work the gain in labor for the world was thus ten-fold. Multiply this by steam power, water power, air power, and above all, electric power, and one has a problem in mechanical progression. — Popular Mechanics.

FUSION OF GLASS ELECTRICALLY.

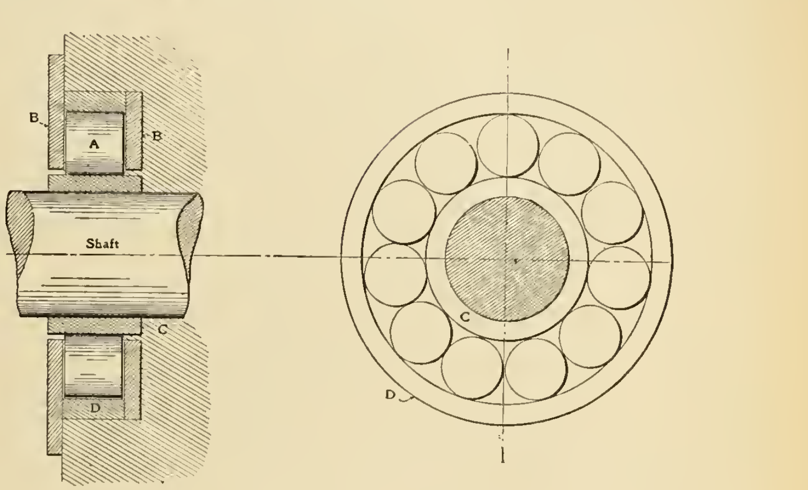
VARIOUS types of electric furnaces have been devised for the production of glass, with more or less success. Experiments made with furnaces of the arc type show that from four to six kilowatt-hours are required to produce a kilogramme of molten glass. The glass obtained contained considerably more silicon than the ordinary mixtures, so that this electric furnace will be useful if glasses of this type are desired; but for ordinary purposes it is too expensive. Another type of furnace having some advantages over the arc is that in which the heating material is powdered carbon or kryptol. In furnaces of this type the material to be fused is placed in a containing vessel which is then surrounded by the resistance material. This enables an excellent heat insulation to be obtained, and thus reduces very greatly the loss due to radiation. When putting in the resistance material it is necessary to see that it is not compacted, and that the grains are of uniform size and evenly distributed around the crucible. The arrangement of the furnace may be such as to produce a higher temperature at one part than at another. One difficulty in using a furnace of this type is the high current density employed, but a suitable regulating rheostat has been devised which consists of an insulated cylinder filled with the powdered material. A block of carbon at the bottom forms one electrode, and the second electrode is a rod of carbon or some other material which is forced down into the loose material. The conducting mass may be distributed around the crucible in various ways. In some of them triangular sticks of carbon are placed in contact with the crucible in order to concentrate the current there. By means of this arrangement the glass may be fused at low temperatures compared with the temperature of the arc. The furnaces may be regulated to give any temperature up to 1,600 to 1,700 degrees centigrade, with a precision of ten to fifteen per cent. The voltage used in the experiments was about 100.—Bulletin de la Societe d'Encouragement.

CAGELESS ROLLER BEARINGS.

THIS bearing has rollers whose length is equal to their diameter, the end faces being carefully ground and the limit of variation allowed on the length being 0.001 inch. The rollers are ground truly parallel and round to within a limit of variation of 0.0005 inch, the rollers being 3-4 inch in diameter. Referring to the sketch, A,A are the rollers and B,B mild-steel plates, between which they run, and which are ground on their inner faces; these plates are preferably case-hardened. C is a cast-steel sleeve, pressed on to the shaft and accurately ground on its periphery. D is a cast-steel bushing pressed into the housing and ground on its internal diameter, the limits in both cases being 0.001 inch. Both bushing and sleeve as well as rollers are hardened. The maximum load on this bearing is about 800 pounds, and the maximum number of revolutions about 300 per minute, the bearing being subjected at the same time to considerable shock.

Our experience shows that for bearings of the cageless type it is undesireable that the length of the roller should be appreciably greater than its diameter, otherwise the roller will get askew and bind on the ends. While the above bearing is somewhat expensive to construct, it has proved itself quite satisfactory under very severe conditions, and where the saving of power is a consideration the expenditure is amply justified.

The double lines at the ends of the rollers in the sketch represent a slight chamfer, and not a clearance, as would appear at first sight, the clearance in this direction being only about 0.002 inch.—American Machinery.



A Cageless Roller Bearing.

In last issue of Canadian Machinery, in mentioning some of the plants where the Eco Magneto Clock had been installed, appeared the name, Cox Foundry Co., which should have read Canada Foundry Co. Besides those mentioned the newly erected plant of the National Casket Co. is being equipped with the Eco Magneto Clock.

The Spiral Gear Problem

BY JOHN EDGAR

IN spite of the fact that this subject has been pretty well treated in various papers it still shows room for improvement. It is a problem that most practical men resort to the crudest of "cut and try" methods in its solution in preference to the more systematic methods at hand.

The problem has been attacked by both graphical and analytical means. There are a great many objections that can be made showing for what reasons they are not more in common use. The graphical method has probably received more attention than any other method of solving this problem. My great objection to this method as a class is made on the ground that the man who has only occasional use for it forgets from time to time the methods of procedure. He is consequently forced to go through another course of instruction, which no doubt reminds him of his early struggles with Euclid. Granting that he does not forget, it is not always convenient to clear things away to make room for a lay-out. The analytical solutions thus far given have been of a very complex nature, so complicated in fact as to be wholly out of consideration in practical work.

I have always felt that it must be possible to construct a few simple formulas that would cover any case that might come up in this useful form of toothed gearing. In what follows I present a systematic treatment of this perplexing problem and hope that it may prove beneficial to those that have any difficulty in its solution.

The figure is drawn to represent a pair of spiral gears in position. The letters indicate the various dimensions with which we are to deal. It is taken for granted that we are to deal with gears cut with rotary cutters on a milling machine. The cutters to be made according to the Brown & Sharpe system of interchangeable gearing.

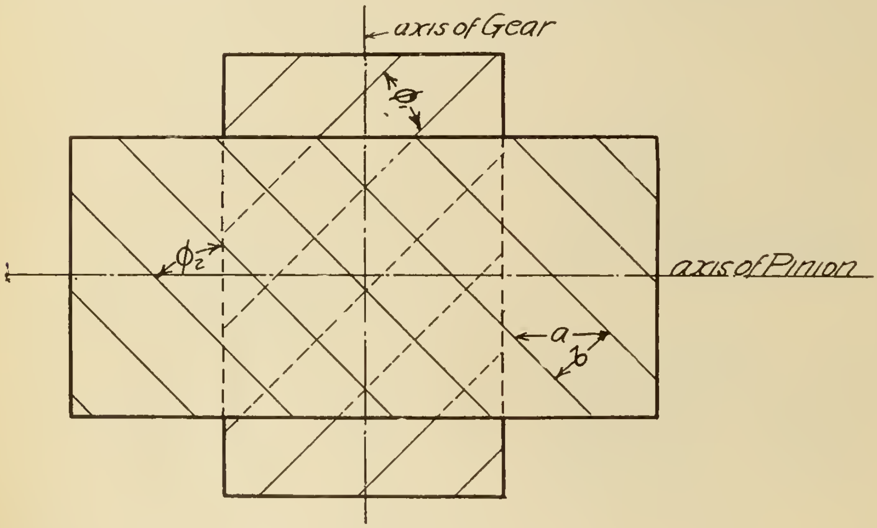


Diagram Showing Relative Position of Gears.

The real or circular pitch which governs the diameter for a fixed number of teeth, or the number of teeth the diameter being given will be found in the figure to be α. The pitch which determines the angle of the teeth for a given circular pitch is the circular pitch of the cutter and is called the normal pitch of the gear, shown in the figure at β.

By trigonometry the ratio of β to α gives us the cosine of the angle of the teeth with the axis of the gear or shaft. As a formula this becomes :

$$\cos.\ \phi = \frac{\beta}{\alpha}$$

$$\text{or } \alpha = \frac{\beta}{\cos.\ \phi} \quad \text{.................. (1)}$$

This formula gives us the relation between the circular pitch of the gear and the normal pitch, which is the circular pitch of the cutter.

In all machine cut spur gearing we express the number of teeth in terms of the diameter and obtain what is called the diametral pitch. This reduces the calculations to a simple proposition. The amount of work thus saved is only realized by those who have calculated gears from the circular pitch of the teeth. Why this more convenient method is not more frequently used in spiral gear work is a wonder to me. It is on this diametral pitch that the following treatment is based.

If we express the relation between the diametral pitch and circular pitch by a formula, using P and p to represent the diametral pitch of gear and cutter respectively, we obtain :

$$P = \frac{3.1416}{\alpha} \quad \text{.................. (a)}$$

$$\text{and } p = \frac{3.1416}{\beta} \quad \text{.............. (b)}$$

from which

$$\beta = \frac{3.1416}{p} \quad \text{.............. (c)}$$

To express the diametral pitch of the gear in terms of the circular pitch of the cutter we substitute (1) in (a) and get

$$P = \frac{3.1416 \times \cos.\ \phi,}{\beta} \quad \text{.......... (2)}$$

Substituting the value of b as given in (c) we have

$$P = \frac{3.1416 \times \cos.\ \phi \times}{3.1416} \;—\; P = \cos.\ \phi \times p \;..(3)$$

Here we have the diametral pitch of the gear expressed in terms of that of the cutter. The number of teeth is equal to the product of the diameter and the diametral pitch. If we represent the number of teeth in the pinion and gear respectively by N1 and N2 and their diameters by D1 and D2 we have the above fact expressed in the following formulas :

$$N_1 = D_1 \times P \quad \text{.................. (d)}$$

$$N_2 = D_2 \times P \quad \text{.................. (e)}$$

or by substituting value of P as given in (3).

$$N_1 = D_1 \times p \times \cos.\ \phi_1 \quad \text{.......... (4)}$$

$$N_2 = D_2 \times p \times \cos.\ \phi_2 \quad \text{.......... (\ )}$$

or for shafts that are 90° apart we get

for........................... (5)

$$N_2 = D_2 \times p \times \sin.\ \phi_1 \quad \text{.......... (6)}$$

From (4), (5) and (6) we may, by transposing, get the diameters thus :

$$D_1 = \frac{N_1}{p \times \cos.\phi_1} \quad \text{.................. (7)}$$

$$D_2 = \frac{N_2}{p \times \cos.\phi_2} \quad \text{.................. (\ )}$$

and for shafts at 90° only

$$D_2 \frac{N_2}{p \times \sin.\ \phi_1} \quad \text{.................. (9)}$$

We know that the centre distance between the shafts is equal to one-half the sum of the diameters of the gear and pinion, or :

$$C = \frac{D_1 + D_2}{2} \quad \text{.................. (f)}$$

multiplying by 2 we have

$$2\,C = D_1 + D_2 \quad \text{.................. (g)}$$

Substituting here values of D_1 and D_2 as given in (7) and (8) we get

$$2C = \frac{N_1}{p \times \cos.\phi_1} + \frac{N_2}{P \times \cos.\phi_2} \quad \ldots\ldots(h)$$

dividing by N_1 we get

$$\frac{2C}{N_1} = \frac{1}{P \times \cos.\phi_1} + \frac{N_2}{N_1 \times P \times \cos.\phi_2}$$

substituting for N_1 (in the first member) the value given in (4) we get

$$\frac{2C}{D_1 \times P \times \cos.\phi_1} = \frac{1}{P \times \cos.\phi_1} + \frac{N_2}{N_1 \times P \times \cos.\phi_2}$$

multiplying by $(p \times \cos.\phi_1)$

$$\frac{2C}{D_1} = 1 \times \frac{N_2}{N_1} \times \frac{\cos.\phi_1}{\cos.\phi_2} \quad \ldots\ldots\ldots(10)$$

transposing

$$\text{Cos.}\,\phi_1 = \left(\frac{2C}{D_1}\right)\frac{N_1}{N_2} \times \cos.\phi_2 \quad \ldots\ldots(11)$$

Formula (11) gives us the relation between the angles of the gear and pinion for shafts at any angle. But since sine ϕ_1 is equal to the cosine of its complement ϕ_2 we have, for shafts at 90°, from (10)

$$\frac{2C}{D_1} = 1 + \frac{N_2}{N_1} \times \frac{\cos.\phi_1}{\sin.\phi_1}$$

and since $\frac{\cos.\phi_1}{\sin.\phi_1}$ is equal to cot. ϕ_1 we have

$$\frac{2C}{D_1} = 1 + \frac{N_2}{N_1}\cot.\phi_1$$

$$\text{or}\quad \cot.\phi_1 = \left(\frac{2C}{D_1} - 1\right)\frac{N_1}{N_2} \quad \ldots\ldots\ldots\ldots(12)$$

The speed of a gear is inversely proportional to the number of teeth, therefore we see from this, calling S_1 and S_2 speeds of pinion and gear respectively, that

$$\text{Cot.}\,\phi_1 = \left(\frac{2C}{D_1} - 1\right)\frac{S_2}{S_1} \quad \ldots\ldots\ldots(13)$$

It can be shown similarly that

$$\text{Cot.}\,\phi_2\ \text{sin.} = \left(\frac{2C}{D_2} - 1\right)\frac{N_2}{N_1} \quad \ldots\ldots\ldots(14)$$

and

$$\text{Cot.}\,\phi_2 = \left(\frac{2C}{D_2} - 1\right)\frac{S_1}{S_2} \quad \ldots\ldots\ldots(15)$$

In order to set the milling machine we must have the pitch of the spiral, which is found by the formula :

$$\text{Pitch of spiral} = \frac{3.1416 \times D}{\text{Tan.}\,\phi} \quad \ldots\ldots\ldots\ldots(16)$$

To find the number of teeth for which to select the cutter we have from Mr. Halsey's "Worm and Spiral Gearing" the following formula :

$$N_\circ = \frac{N}{\text{Cos.}^3\phi} \quad \ldots\ldots\ldots\ldots\ldots\ldots(17)$$

We now have all that is necessary for finding the data for cutting the gears.

Let us apply these methods to a few examples. The first to be the case of connecting two shafts at right angles with spiral gears of approximately equal diameters, say about 6 inches, using a 6 pitch cutter in cutting. Speed ratio 2 to 1.

Solution : We apply (13) and find the angle.

$$\text{Cot.}\,\phi_1 = \left(\frac{12}{6} - 1\right)\frac{1}{2} = .5$$

This corresponds to 63° 26′.

Now apply (4) to find the number of teeth.

$N_1 = 6 \times 6 \times .44721 = 16.1$, or say 16 teeth.

The gear runs only half as fast as the pinion therefore must have twice as many teeth, or 32.

Applying (7) and (8) we get the true diameters, thus :

$$D_1 = \frac{16}{6 \times .447} = 5.962'' \text{ for pinion}$$

$$D_2 = \frac{32}{6 \times .8944} = 5.963'' \text{ for gear.}$$

$$\text{Centre distance} = \frac{5.962 + 5.963}{2} = 5.9625''$$

The outside diameter is figured by the same rule as for spur gears, which is to add twice the reciprocal of the pitch number of the cutter, to the pitch diameter

$$\text{O.D.} = D + \frac{2}{p}$$

Let it be required, for a second example, that the centre distance be fixed at 6″.

This problem requires that we adjust the angle so that the diameter of one gear will increase and the other decrease but at different rates in order to make up the difference in centre distance. Now on inspecting a table of sines and cosines it is found that the cosine of ϕ decreases at a very much greater rate than its sine increases for every increase in the angle. And from (7) and (9) we see that the diameter is inversely proportioned to the cosine and sine of this angle, for pinion and gear respectively. Therefore we see that we must increase the angle of the pinion in order that we may make up our centre distance.

To find this new angle we apply (15) thus :

$$\text{Cot.}\,\phi_2 = \left(\frac{12}{5.963} - 1\right) 2 = 2.25$$

This is the cotangent of 26° 17′ nearly.

To find new diameters apply (7) and (8)

$$D_1 = \frac{16}{6 \times .4428} = 6.02'' \text{ for pinion.}$$

$$D_2 = \frac{32}{6 \times .89667} = 5.95'' \text{ for gear.}$$

We now have a centre distance of

$$C = \frac{5.95 + 6.02}{2} = \frac{11.97}{2} = 5.985''$$

We are still out thirteen-thousandths, so we repeat the operation, and get

$\phi_1 = 63°\ 49'$
$\phi_2 = 26°\ 11'$
$D_1 = 6.048''$
$D_2 = 5.942''$

and C = 5.995, we are still out five-thousandths.

Another application gives

$\phi_1 = 63°\ 52'$
$\phi_2 = 26°\ 8'$
$D_1 = 6.054''$
$D_2 = 5.942''$

This gives

C = 5.998″, out only two thousandths. Applying again we get

$\phi_1 = 63°\ 52'$
$\phi_2 = 26°\ 8'$
$D_1 = 6.072''$
$D_2 = 5.927''$

This gives

C = 5.9995″, only one-half thousandths.

This result is probably as accurate as we can get through the use of the slide rule, which I have used on all calculations in this article.

For a third example, let us apply the conditions of the first, with the exception that the shafts are set at an angle of 70 deg. instead of 90.

In this, as in all cases with shafts at any angle other than the right angle, we use formula (11) which gives :

$$\text{Cos.}\,\phi_1 = \left(\frac{2 \times 6}{6} - 1\right)\frac{2}{1} \times \cos.\phi_2$$
$$= 2\cos.\phi_2\,.$$

This shows us that the cosine of the angle of the pinion is one-half that of the gear. The method of procedure, in a case of this kind, is to pick out from trigonometrical tables cosines having the desired ratio, being sure that the sum of their corresponding angles is equal to the angle between the shafts. By applying this method to our present case we find that

Cos. ϕ_1 = .49318 = Cos. 60° 27′
Cos. ϕ_2 = .98614 = Cos. 9° 33′

Next apply (4) to find the number of teeth.

$N_1 = 6 \times 6 \times .49318 = 17.75$, or say 18 teeth.

Since the speed ratio is 2 to 1 the gear must have $18 \times 2 = 36$ teeth.

To find the diameters we apply (7) and (8).

$$D_1 = \frac{18}{6 \times .49318} = 6.08''$$

$$\text{and}\quad D_2 = \frac{36}{6 \times .98614} = 6.08''$$

This gives a centre distance of 6.08″.

To make the formulas more accessible for reference I have collected them in tabular form which will be appreciated

by any who may wish to adopt this method of solving the problem.

TABLE OF FORMULAS.

Notation

ϕ_1 and ϕ_2 = angle of teeth for pinion and gear respectively.

D_1 and D_2 = diameter of pinion and gear respectively.

N_1 and N_2 = number of teeth in pinion and gear respectively.

S_1 and S_2 = revolutions of pinion and gear respectively.

p = diametral pitch of cutter.

FORMULAS FOR SHAFTS AT ANY ANGLE.

$$\text{Cos. } \phi_1 = \left(\frac{2C}{D_1} - 1\right) \frac{N_1}{N_2} \times \cos. \phi_2$$

$$N_1 = D_1 \times p \times \cos. \phi_1$$

$$N_2 = D_2 \times p \times \cos. \phi_2$$

$$D_1 = \frac{N_1}{p \times \cos. \phi_1}$$

$$D_2 = \frac{N_2}{p \times \cos. \phi_2}$$

$$\text{Pitch of spiral for pinion} = \frac{3.1416\, D_1}{\text{Tan. } \phi_1}$$

$$\text{Pitch of spiral for gear} = \frac{3.1416\, D_2}{\text{Tan. } \phi_2}$$

Number of teeth for which to select cutter

$$N' = \frac{N_1}{\text{Cos.}^3 \phi_1} \text{ for pinion.}$$

Number of teeth for which to select cutter

$$N'' = \frac{N_2}{\text{Cos.}^3 \phi_2} \text{ for gear.}$$

FOR SHAFTS AT 90° ONLY.

$$O\, D_1 = D_1 + \frac{2}{p}$$

$$O\, D_2 = D_2 + \frac{2}{p}$$

$$\text{Cot. } \phi_1 = \left(\frac{2C}{D_1} - 1\right) \frac{N_1}{N_2} \text{ or } \left(\frac{2C}{D_1} - 1\right) \frac{S_2}{S_1}$$

$$\text{Cot. } \phi_2 = \left(\frac{2C}{D_2} - 1\right) \frac{N_2}{N_1} \text{ or } \left(\frac{2C}{D_2} - 1\right) \frac{S_1}{S_2}$$

$$N_2 = D_2 \times p \times \sin. \phi_1$$

$$N_1 = D_1 \times p \times \cos. \phi_1$$

The above appeals to me as being about as simple a solution as one could wish to a problem that has given so much trouble. No doubt objections will be made to the repeated application of the formulas in the case of fixed centres. But you must admit, on second thought, that this is a very simple operation especially when one is supplied with a slide rule and that in only one case in a hundred is the centre distance fixed.

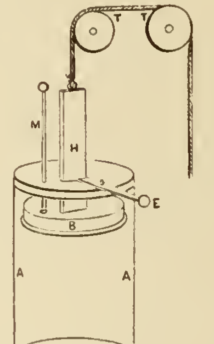
From my statement in the beginning I might have left the impression that all graphical methods are to be looked upon as unsatisfactory. This is hardly the case, being merely a matter of choice. But my experience has placed me in favor of using a simple formula in the solution of all problems where such a formula can be found.

Harnessing Steam

(Continued from last issue.)

Second Period.

It will be noticed that up to the time of Savery a steam-engine, in the modern sense, had not been developed. The water elevators of Worcester and Savery would be called by us "apparatus," or "appliances," but the true engine, capable of transmitting the force of steam directly to a resistance to be overcome, had not, up to the year 1700, been produced. In order to follow each link in the chain of development it will be necessary to go back to 1678, at which time Jean Hautefeuille, of France, proposed a gunpowder engine, in which the pressure of the gases of explosion were to drive a piston in a cylinder. This, so far as is known, was the first time the idea of a moving piston in a heat engine was advanced, and the suggestion materially advanced the future development of the steam engine. The idea was further elaborated by Huyghens, who built a gas engine, the explosive agency being gunpowder. The explosion of the powder drove the air out of a cylinder, under a piston which was open to the atmosphere on one side. When the products of combustion cooled a partial vacuum was formed, and the atmospheric pressure drove down the piston, which, through the medium of a cord and pulley, performed a certain amount of work. Huyghen's explosive engine was further developed by Denis Papin, who had been assistant to the inventor in Paris. Papin abandoned gunpowder as a source of power, and raised the piston by steam power, afterwards permitting the steam to condense, so that the pressure of the atmosphere forced the piston down. This was the first steam engine with a piston, and the first piston steam engine in which condensation was used to secure a vacuum.



Papin's Engine.

Papin's Engine.

The illustration shows the crude form of this early attempt. A small quantity of water was placed at the bottom of the cylinder, A, a fire was built beneath it the bottom being made of very thin metal, and the steam formed raised the piston, B, to the top where the latch, E, engaging a notch in the piston rod, H, held it up until the operator was ready for the down stroke. The fire being drawn the steam condensed, the latch was disengaged and the atmospheric pressure produced another stroke. The piston speed was about one stroke per minute.

In 1705 Newcomen, a blacksmith of Dartmouth, England, assisted by John Calley, a glazier, made the piston engine a practical success by separating the boiler from the cylinder, and using artificial means of condensation, as Savery had previously done. The Newcomen engine was, in fact, a development from the experiments of Papin and Savery, but Newcomen was the first man to combine previously known elements so as to produce practical results.

Newcomen's Atmospheric Engine, 1705.

The illustration makes the operation of this engine sufficiently plain. It will be noticed that the steam was condensed by a jet of cold water. In the first engine condensation was effected by cooling the outside of the cylinder, but some leakage of water past the piston accidentally showed the advantage of a jet of injection water, and this plan was substituted for surface condensation in all subsequent machines.

The original engines were probably not

automatic, but an old print of an engine erected in 1712 shows a kind of automatic gear. The story goes that in 1713 a boy—one Humphrey Potter—becoming weary of opening and closing valves on an engine he attended, the duty being one which would natutally pall upon a youthful mind, made the machine automatic by attaching the various valves, or cocks, to the walking beam by means of cords and levers. The Newcomen engine was later improved in mechanical details by Henry Beighton and John Smeaton, and continued to be the standard pumping engine until the time of Watt. It was, owing principally to the alternate heating and cooling of the cylinder, a vast consumer of fuel, but this did not prevent a large number being used, mainly for pumping water from mines. In 1767 Smeaton reported 57 engines at work near Newcastle alone, aggregating 1,200 horsepower.

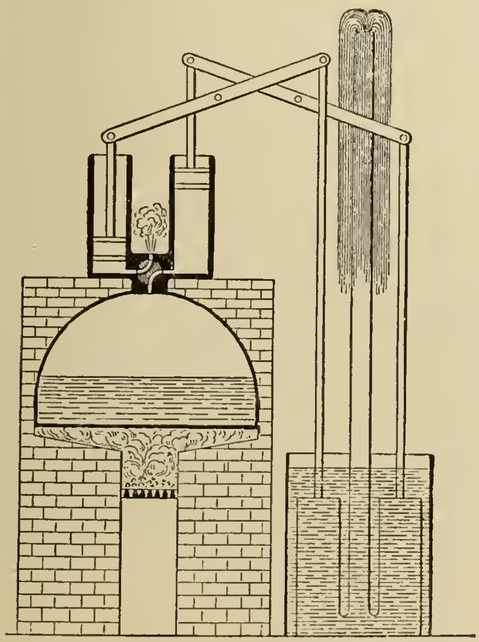
In 1725 a high pressure, non-condensing engine was described by Leupold in his "Threatrum Machinarum," which was probably the first of its kind. The following illustration is sufficiently clear.

Leupold Non-Condensing Engine.

The machine does not appear to have been developed commercially, the reason being, no doubt, that with the knowledge of boiler-making and piping then available, and the utter lack of suitable materials, a machine could not be constructed to work safely under a comparatively high pressure.

James Watt.

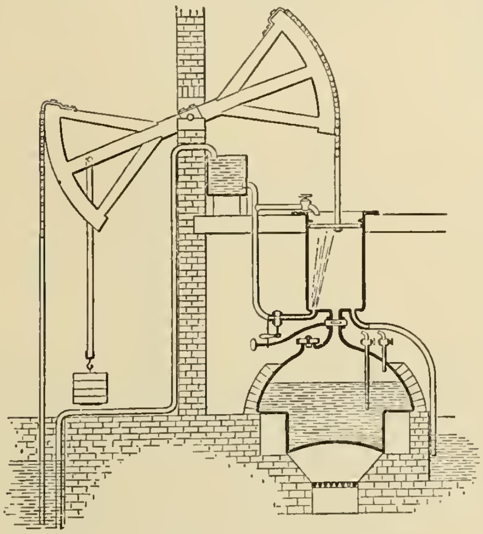
The steam engine had been slowly developed to a point where it could be



Non-Condensing Engine, Leupold, A.D. 1725.

used commercially for the purpose of pumping water, but its small power, in comparison with the size of the parts and the extraordinary consumption of fuel, limited its field of usefulness. It remained for James Watt to elucidate the correct principles of steam engineering, and so improve upon the mechanism of the engine itself that it could be widely utilized as a prime mover, and become the most potent element in the industrial development of the world.

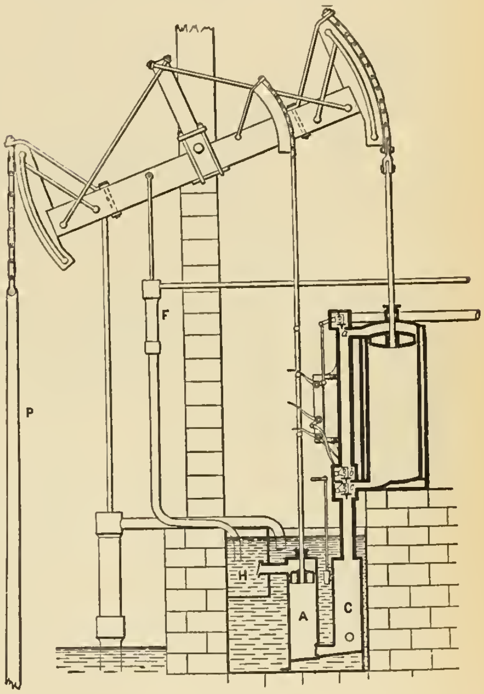
Space will not permit an extended biography, but a few facts bearing upon his early life and training will be of interest. Watt was born at Greenock, a small Scotch village, January 19, 1736. His grandfather, Thomas Watt, was a well-known mathematician and schoolmaster. His father was a prominent citizen of Greenock, and at various times was chief magistrate and treasurer of the town. James Watt was a bright boy, but so delicate in health that he was unable to attend school regularly or apply himself to study, and consequently his early education was



Newcomen's Atmospheric Engine, A.D. 1705.

given him principally by his parents, who were people of intelligence. At about fourteen years of age he commenced to forge ahead in the village school, excelling in mathematics. During his spare time he made many ingenious pieces of mechanism, among other things a barrel-organ, and showed marked ability with tools, working both in wood and metal. At the age of eighteen he was sent to Glasgow to learn the trade of a mathematical instrument maker, but soon went to London, where he worked for John Morgan at instrument making for a year, when his health failed and he had to return home.

The following year he again went to Glasgow with the intention of opening a shop, but the guilds, or trades unions, would not permit him to do so, and Dr. Dick, of the University of Glasgow, came to his aid and gave him employment at the university, repairing and overhauling the scientific apparatus belonging to the college. There he remained nearly four years, making philosophical experiments and manufacturing mus-



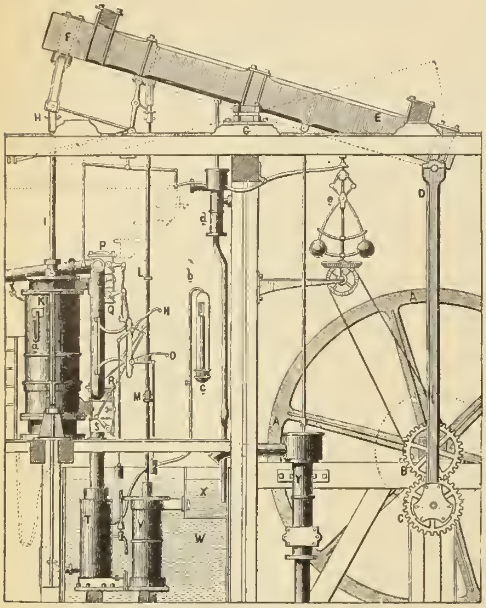
Watt's Single-Acting Engine, A.D. 1769.

ical instruments. In order to make himself more familiar with the science of acoustics he studied German and Italian. Watt also studied chemistry, assisted by Dr. Black, who was then engaged in making researches which resulted in the discovery of "latent heat."

At this time it was proposed that he repair the model Newcomen engine in the college collection, and this led him to make a study of the few treatises then existing on steam, and to become familiar with what had already been accomplished in the way of its application to useful work. After putting the engine in working order he commenced to experiment with it in 1764, and was struck with the waste of steam due to the alternate chilling and heating of the cylinder. He saw that the remedy was to keep the cylinder as hot as the steam which entered it, and as this was impossible with a condensing jet of cold water in the cylinder itself, he added to the engine an entirely new feature—a separate condenser — into which the steam should be allowed to escape to be then condensed by a jet, or external application of water. To preserve the vacuum, he added an air pump to remove from the condenser the water of condensation and whatever air there might be. His next step was to steam-jacket the cylinder, bringing the piston rod out through a stuffing box, and allowing steam, instead of air, to press upon the upper surface of the piston. These improvements were patented in 1769.

Watt's Single-Acting Engine, 1769.

The illustration is an example of this period. The engine is still single-acting, and although the top of the piston is



Watt's Engine, 1781.

closed and steam is admitted above the piston, this was only done to keep the cylinder warm, the steam merely taking the place of the atmospheric pressure, and it is the lower end of the cylinder only which is put in communication with the condenser. There are three valves, the steam valve, a, the equilibrium valve, b, and the exhaust valve, c. At the commencement of the down stroke c is opened to produce a vacuum below the piston, and a opens to admit steam. At the end of the down stroke a and c are shut and b is opened. This puts both sides of the piston in equilibrium, and the piston is pulled up by the weight of the pump rod, p.

In 1781 Watt obtained a patent for the so-called "Sun and Planet" wheel method of making the engine give continuous revolving motion to a shaft provided with a fly-wheel. The crank and connecting rod was a device well known at that time, through being used on the foot lathe, but the application of the crank to a steam engine had already been patented by one Pickard, so that Watt could not use it until the expiration of the patented term.

In 1782 another patent was issued to Watt, covering principles of great importance. The patent included :

1st. The expansion of steam and six methods of applying the principle and equalizing the expansive power.

2nd. The double-acting steam engine, in which the steam acts on each side of the piston alternately, the opposite side being in communication with the condenser.

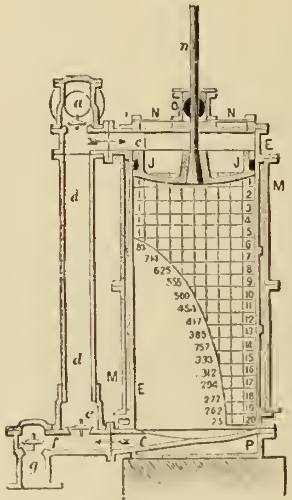
3rd. The doubled, or coupled, steam engine—two engines capable of working together, or independently.

4th. The use of a rack on the piston rod, working into a sector on the end of the beam, thus securing a perfect rectilinear motion of the rod.

5th. A rotary engine, or "steam wheel."

Watt studied and developed the working of steam expansion, and suggested a cut-off at quarter stroke as being the most economical, and in a communication to Dr. Small illustrated the idea by a sketch similar to the following :

Among the other inventions of Watt were the water gauge, steam engine indicator, ball governor, the poppet valve with beveled seat, throttle valve, similar to our present butterfly valve, cross head and guides, for engine piston rods, a steam hammer, and the revolution counter. This remarkable man left the steam engine a complete machine, and while countless investigators have added to our scientific knowledge, ingenious mechanics working with better material



Expansion of Steam by Watt.

and tools have refined and developed, still the engine of to-day embodies all the essential features of the machines which his intellect created.

James Watt died August 19, 1819, in the eighty-third year of his life, and a monument was erected to his memory in Westminster Abbey, upon which there is engraved the following noble epitaph :

Not to perpetuate a Name,
which must endure while the peaceful
arts flourish, but to show
that mankind have learnt to honor
those who best deserve
their gratitude,

THE KING,

his Ministers, and many of the nobles
and commoners of the realm,
raised this monument to

JAMES WATT,

Who, directing the force of an original
genius, early exercised in philosophic research, to the improvement of

THE STEAM ENGINE,

enlarged the resources of his country,
increased the power of man, and
rose to an eminent place
among the most illustrious followers of
science and the real benefactors
of the world.
Born at Greenock, MDCCXXXVI.
Died at Heathfield, in Staffordshire,
MDCCCXIX.

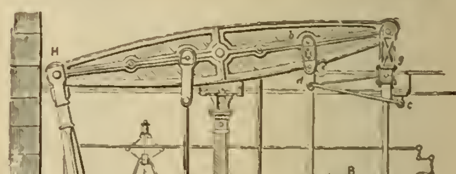
"DO THE HARD THINGS FIRST."

A BANK president was asked to what one thing more than all others could he attribute his success. He pointed to a small printed motto which hung above his desk; it read: "Do The Hard Things First!"

"I came across that motto years ago," he said, "at a pivotal point in my life. I had for some time felt burdened by my position. That motto was a flashlight to my intelligence. I suddenly realized that I had been in the habit of putting off the disagreeable duties, of evading the unpleasant tasks, and they had formed a ghost which haunted me and held me back. I tacked up that motto and settled down to work on the disagreeable duties I had pushed aside; soon I had them out of the way, and ever afterwards I attempted the hardest thing first. I gave my freshest efforts to the work I dreaded most and I owe what is called my success largely to this awakening and change of tactics."

PERSISTENCE.

Nothing in the world will take the place of persistence. Talent will not—nothing is more common than unsuccessful men of talent. Genius will not—unrewarded genius is almost a proverb. Education will not—the world is full of educated men who have been failures.



Boulton & Watt's Double-Acting Engine, A.D. 1784

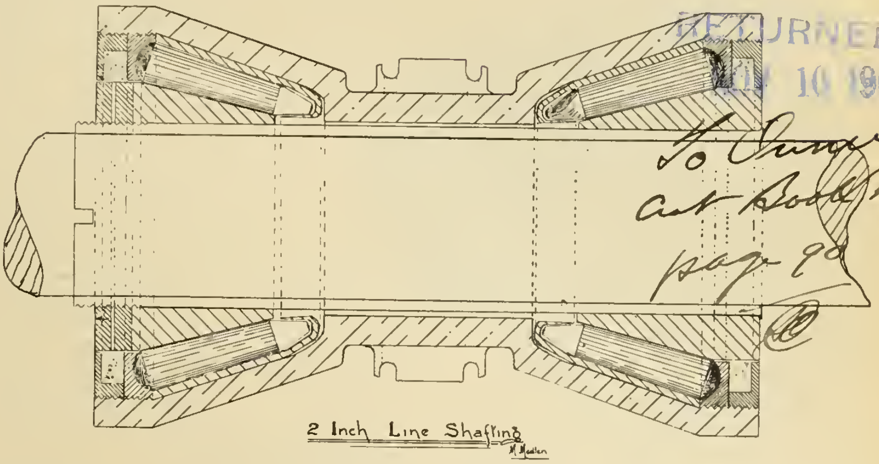
Determination alone is omnipotent. "Press on" has solved, and always will solve, the problems of the human race. —The New Empire.

Bearings --- Ball and Taper

TAPER ROLLER BEARINGS.

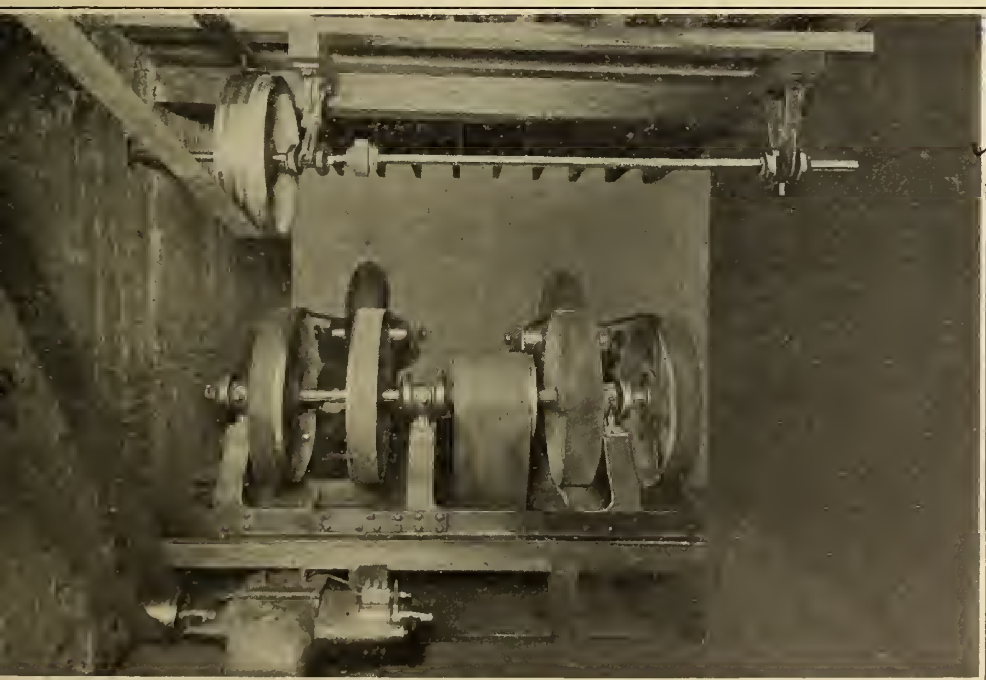
IN the Wright Taper Roller Bearing, manufactured at Hamilton by Canadian Bearings Limited, are to be found a radical departure in roller bearings. The points that are claimed and have been proved for this bearing over all others are as follows: 1. The end thrust is entirely absorbed. 2. Perfect adjustment for possible wear. 3. Taper-shaped rollers. 4. A full series of rollers. 5. Rollers have a free race. 6. No cage. One of the chief claims to excellence over all the other roller bearings is the fact that no cage is used in this bearing. It is a fact, based on mechanical knowledge, that cages in bearings are objectionable, being one of the first parts to wear and interfere with its free utility. 7. A self adjuster, consequently imperfect adjustment is impossible. 8. Absolutely mechanically and theoretically correct. 9. For all purposes. 10. Minimum number of parts. 11. Simplicity of construction. 12. Saves 40 to 75 per cent in power. 13. Saves 95 per cent. in oil. 14. Experimental stage passed. 15. Worth fully proven. 16. Cheap.

This bearing is the only scientific bearing in the world. It is unlike a straight roller bearing, inasmuch as it takes up, or eliminates the end thrust entirely, this result being attained owing to the geometrical feature that the vertices of the conical roller lie in the axis of the shafts, and coincide with the conical treads, and secondly, that the resultant pressure on the bearing does not make an angle greater than an angle of repose, with the normal either to the inside or the outside rolling surfaces, treads or seats. There is no slipping, the roller being on a dead angle of repose or asleep.



These bearings have been in very heavy use for several years, and have been thoroughly tested, both for heavy work and for high speed work, and are of such material and workmanship that there is every reason to be satisfied that once they are known the demand will be enormous, as there is practically no wear whatever. They are being manufactured for line shafting, horse vehicles, in fact for any place where there is a complete revolution.

For heavy work, such as water wheels, the power that will be saved will more than pay for the cost of installation. These bearings require lubricating, as all practical men will readily acknowledge for two reasons: First, all metals coming together will run easier if a lubricant is used; second, to prevent sweating, and also rust, if standing idle. A light oil is all that is necessary, as the rollers keep the oil in. The felt washer, as shown in the cuts, keeps the oil in and the dirt out; it is simple and does the work. For horse vehicles the trouble of removing the hub to oil is done away with. All that is necessary is to remove the oil stud and oil with an ordinary oil can.



Tandem Blower Equipment, Diamond Glass Company, 2,200 Revolutions Per Minute, Day and Night.

THE CHAPMAN DOUBLE BALL BEARING AS POWER SAVER.

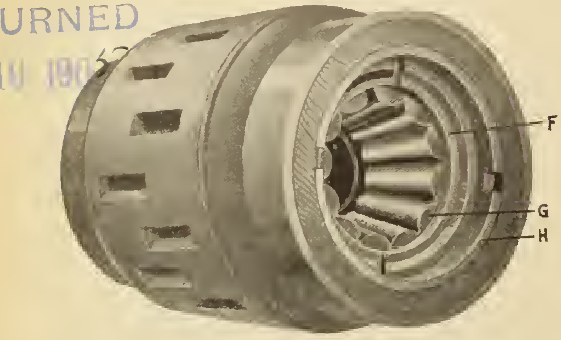
A DISCUSSION, setting forth in technical terms the merits of the Chapman double ball bearing, might prove interesting and instructive to many readers of this paper, but the majority of power users deal with facts rather than theories, hence prefer facts in a description.

In general terms, the main difference between the double ball bearing and the plain journal is the two kinds of friction represented. In the journal bearing we have sliding or rubbing friction, while in the ball bearing we have rolling friction. In other words, we have a dependent and a non-dependent bearing. For example, in the journal bearing lubricant must be applied to overcome the friction between the sliding parts; in the ball bearing, however, lubricant is applied as a precaution

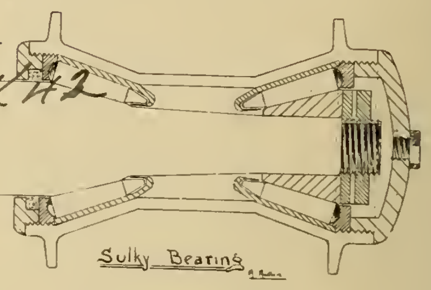
against foreign matter and rust rather than for lubrication purposes. With the above distinctive features before us, it is not difficult to see that any increase of load on a journal bearing must necessarily become a dependent load, that is, the more the load is increased, the more the load becomes dependent upon some lubricant to overcome the sliding friction, while in the case of the ball bearing we have a non-dependent friction, hence as the load is increased, the power to do the work is increased only in proportion to the weight of the load, and not the weight of the load plus the increased frictional resistance as in the first instance.

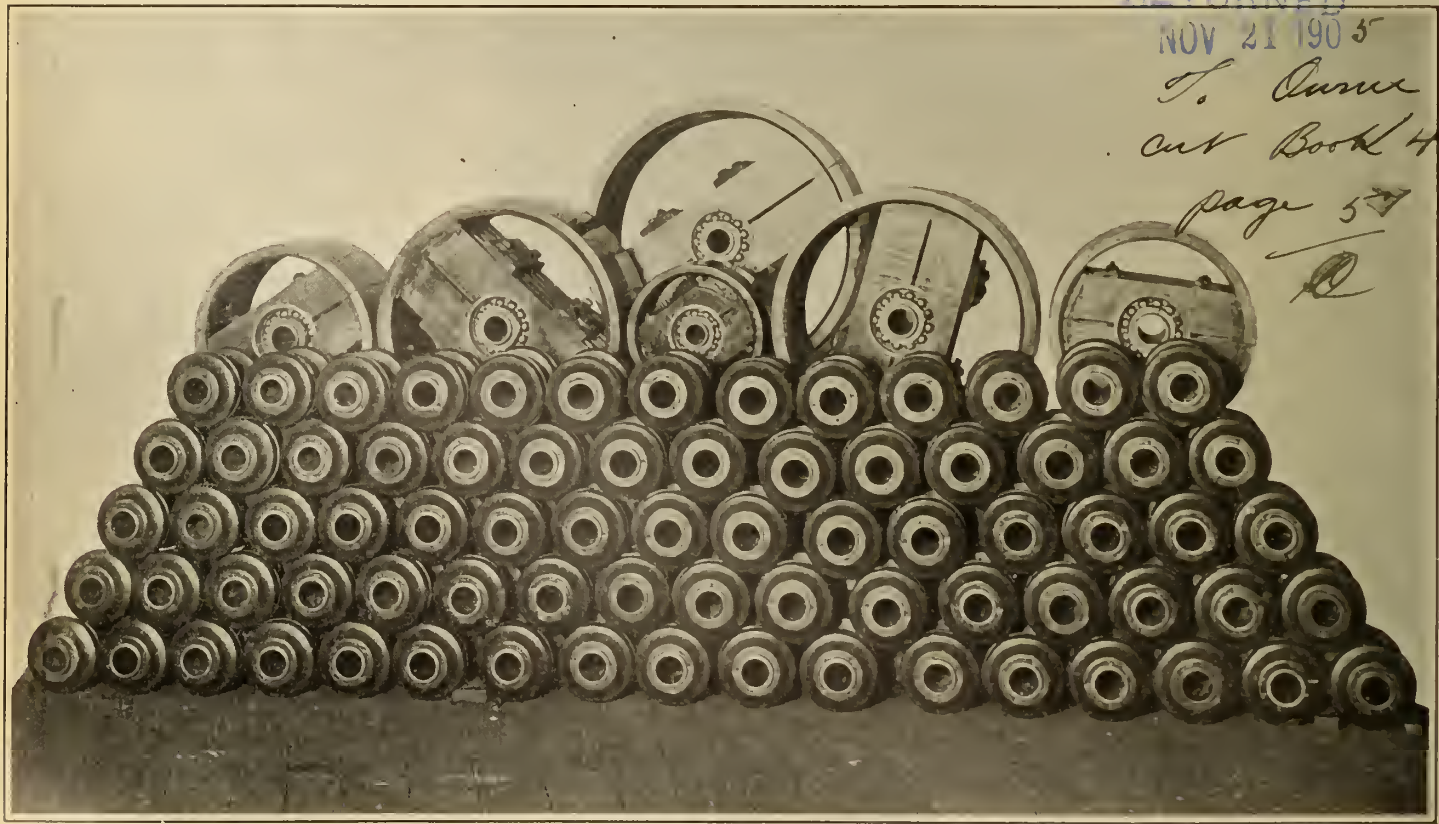
Since the inception of the Chapman bearing three distinct features have been held constantly in mind; first, to design a bearing that would produce tangible results; second, to produce a durable bearing; third, to produce a bearing of simple construction. The remarkable results that have been attained in the power transmission field have been gained by bearing in mind these three laws in the design of this anti-friction bearing. In case any of the above features are lacking in an anti-friction bearing, the result is inevitably failure, as past experience has shown.

In the first instance, for example, it is not enough to say to the average manufacturer that he can make a large saving by the application of your bearings, for he will doubtless meet your argument, as one large manufacturer recently did, by stating: "Were I to adopt all the economic devices that were presented to me during the year, I should be able to run my plant without the use of my engine, and still have power to burn." It is necessary to effect a saving in his cost of operation that will net him a large profit by making this change. Again, an anti-friction bearing may be able to make a large saving, and yet under difficult service prove itself unable to do the work. This feature has been carefully studied by the manufacturers of the Chapman bearing, and every point in its construction has been so designed as to produce a bearing with a life that is practically indeterminate under normal conditions. Simplicity in construction in a ball bearing, as in any other machine, must be always counted on as an important factor, for, as every manu-



Bearing in Wooden Hub.





Equipment of Northern Electric and Manufacturing Company, Montreal.

facturer is aware, a complicated machine in the hands of unskilled labor must prove of short life, while on the other hand, a bearing constructed with the fewest parts has the least liability to get out of order.

One of the strong points that commends the Chapman double ball bearing to power users is the fact that it is adaptable to all classes of standard hangers, that is, the bearing is so designed as to fit with practically no alteration any make of hanger that is now on the market, hence the manufacturer, in contemplating a change, does not find it necessary to go to the expense of buying new hangers. The feature of lubrication in most manufacturing plants is quite an item, but with the installation of the Chapman bearing this is reduced by 95 per cent.

In the power transmission field, besides the application of ball bearings to all classes of shafting, the field of loose pulleys is one of great importance, as the loose pulley, regardless of design, with journal bearings, has proved itself one of the most troublesome features in power transmission, and last, but not least, the mule stand may be classed with the loose pulley. The Chapman bearing, in both of the above applications, has shown itself to be one of the greatest devices ever introduced for eliminating the difficulties attendant upon loose pulleys and mule drives.

The position held by the Chapman double ball bearing as an invention is probably known to only a few people throughout the country. By this is meant the relative position that this bearing holds as a power saving device. At the St. Louis Exposition, in 1904, Mr. Charles H. Chapman, the inventor of this bearing was presented with a special gold medal in recognition of his services as a distinguished inventor. What an award of this kind means to an inventor can best be comprehended when the fact is taken into consideration that among the six other recipients of this medal are found the names of Thomas A. Edison, George Westinghouse, and Sir Charles Parsons.

PERSONAL MENTION

Author of "Practical Mechanics."

In this day of bustle and progress it is customary to find men in industrial plants either so deeply involved in the mechanical or operating side of the concern that they have time for little else or so filled with theories as to bring them further and further from the practical. The evenly balanced man in this respect is the exception, and of these there are but few able to express their ideas in a clear and logical manner. To this latter class belongs Mr. W. H. Raeburn, of Dundas, whose series of articles on "Practical Mechanics" commenced with last issue. Besides being a master of his work Mr. Raeburn is possessed of sterling qualities and a personality that places him high in the esteem of his fellows.

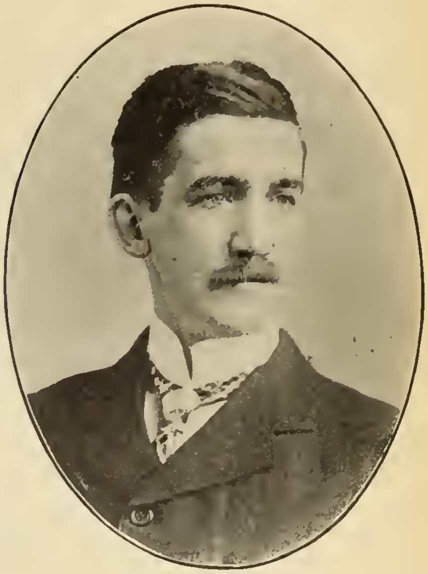
Mr. W. H. Raeburn is a native of Banff, Scotland, where he received his public and high school education. He took a three years' course in the Science and Technology School, Kirkcaldy, Scotland, before coming to Canada, where he at first engaged in railway engineering, spending nearly two years with the C.P.R. Co. and the Owen Sound Quarrying & Construction Co. Settling down in Galt, he devoted himself to mechanical engineering and when compelled by ill health to resign, he held the position of superintendent of the works of Cowan & Co. After a short time spent with the Canadian General Electric Co., in 1901 he went to Dundas where he is engaged on the engineering staff of John

W. H. Raeburn.

Bertram & Sons Co. as machine designer. Mr. Raeburn has also charge of the classes at the Hamilton Art School in machine drawing and design and finds time to do a little writing for both Canadian and American machinery journals.

Head of a New Firm.

W. B. McLean, a cut of whom is herewith presented, was born in Pictou, N. S., where he obtained his early educa-



W. B. McLean, B.Sc.

tion. After spending some time with the Robb Engineering Co., Amherst, N. S., he came to Montreal, entering the Science Faculty of McGill University in 1895. In closing a brilliant course he captured the 1851 Exhibition Scholarship, and elected to take his post-graduate work at Owens College (now Victoria University) in Manchester, Eng., where he studied under Osborne Reynolds and conducted research work in steam. He then went with Dr. Nicholson, taking charge of the experiments for a syndicate, after which he was engaged in the experimental draughting room of Crossley Bros.' Gas Engine Works. He next accepted a position as draughtsman and later as designer with Henry Walworth & Co., Limited, where he assisted in commercializing some important inventions, for which he now holds the Canadian agency.

In this way he formed a wide connection with English machinery firms, so that when he decided upon a return to Canada he was able to get the sole agency for many of them. Accompanied by his wife, an English lady whom he had married in Manchester, he arrived in Montreal on the Virginian July 15th last, and became associated with J. J. Sophus in the present firm.

Mr. McLean's brilliant technical education has been greatly enhanced by his experience in England, the home of the iron and steel industries, and he is splendidly equipped for the business upon which he has entered.

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Vol. I. NOVEMBER, 1905. No. 11

ADVERTISING IN THE COLONIES.

AT the October dinner of the Sphinx Club, in London, England, the subject, "Why Should we Advertise in the British Colonies?" was discussed. In referring to the matter the Engineering Times publishes the following:

"Mr. J. H. Turner, agent-general for British Columbia, said that there was no doubt that good advertising would tend to the advancement of British merchants in the colonies. British Columbia was increasing in population, had an excellent position on the Pacific, and must become an important part of Canada.

"Mr. J. W. Taverner, agent-general for Victoria, pointed out that the colonies were anxious to trade with the Mother Country. Germans and Americans, however, were very successful in getting hold of a large part of that trade. There was still a large field for British manufacturers, and it was the duty of people in Great Britain to do all they could to do business with their brethren across the seas.

"Mr. J. Howard, agent-general for Nova Scotia, said British manufacturers must advertise in order to counteract America's natural advantage of geographical position.

"Mr. J. E. Jenkins, agent-general for South Australia, thought advertisements must be of a nature to 'fetch the people.' The Americans were the best advertisers in the world. Australia wanted trade with Great Britain, but it was the best bargain which was most taking, and British manufacturers should see to it that their goods were the best bargain. Australians did an enormous trade with a small population.

"We have in our columns repeatedly called attention to the importance of advertising in the colonies."

One of the distinguishing traits between the British manufacturer and his American competitor lies in the eagerness with which the latter seeks publicity and the indifference of the former as a rule. To this very fact can be attributed a large measure of the success the American manufacturer has had in competing with the outside world. He realized before any other the all importance of having his name and goods well known by the class of people to whom he catered.

It is not from mere undirected publicity that results are obtained. There is a law in advertising as well as in any department of business. A writer in American Industries, speaking of publicity that pays, says: "It is characterized by the same traits that 'pay' in other walks, by earnestness, by sincerity, by persistence, by integrity, by aptness, by adaptation, and by seizing your topic in such a way as primarily to make it interesting."

When the British manufacturer realizes the big field there is for him in the colonies, a large part of which can be secured only by advertising in a proper medium, and makes a more thorough study of the science of advertising, then will he secure a trade that he is not now getting, but which belongs to him by the fact that tariff regulations were made to have it so.

SOLVING SPIRAL GEAR PROBLEM.

READERS in general, and practical men in particular, will be interested in the article on the "Spiral Gear Problem," on another page of this issue, treated in such a manner as to be appreciated by any having to do with the cutting of spiral gears. A great many writers have gone into this subject, but Mr. Edgar's method of treatment is entirely original and more easy of application than any heretofore offered. The points of merit are: His employing the diametral pitch of the cutter to the exclusion of the circular pitch, the reduction of the whole problem to that of applying the correct formulae and the simplicity of these formulae.

The graphic solution of this has been popular amongst writers, but it generally fails to find application by practical men. Much of the trouble experienced has been due to the fact that most men have used the cut and try method with little or no system. Again, a method requiring memorizing fails because of the general unwillingness to commit it to memory. The formulae given requires no study other than a mere reading of each to explain its use. They may be kept for reference to be used at any time. We are sure this article will be appreciated by a large number of readers.

TECHNICAL EDUCATION FOR APPRENTICES.

MANY defects exist in the apprentice system which prevails in most shops at the present time. Sometimes the apprentices themselves are to blame for the unsatisfactory condition, and not infrequently the fault lies in the managing office.

The apprentices in their eagerness to command journeymen's wages frequently desert their masters to accept employment as regularly qualified mechanics

elsewhere. This tendency to "jump" apprenticeships is already having its effect upon the craft, and it is evident that there are many journeymen in our shops who are imperfectly trained. The problem of checking this tendency is a serious one, which cannot be undertaken too soon if the reputation of Canadian mechanics is to be upheld.

Many schemes have been tried to cajole apprentices into filling out their period of instruction, but those which have come nearest to accomplishing the desired end have been calculated to arouse in the minds of apprentices a feeling of loyalty to their firm. In some cases in addition to a fair wage during appretticeship, a premium is given at the close of the term if the workman's conduct has been satisfactory. Even this, however, has failed to hold men to their apprenticeship when the allurements of journeyman's wages are held before them. Sometimes again a deposit is required of an apprentice on entering the works, to be repaid with interest if he remains for his entire term, and forfeited if he deserts before its completion. This, however, only serves to arouse a spirit of antagonism, and is not calculated to bind an apprentice, if any other opportunity offers.

But some of the large British and American firms have discovered a method which engenders a spirit of loyalty in their apprentices, and at the same time greatly increases their efficiency. This is to give practical encouragement to all apprentices desirous of obtaining a technical education. In this particular the British firms are, perhaps, a little in advance of those in the United States, as nearly all the iron and steel firms in the Old Country are at least making concessions in time to apprentices taking evening educational classes. They are allowed to lay off work in time to enable them to wash up and have their meal in comfort before proceeding to their class. Other firms are accustomed to shorten the apprenticeship term for those who have shown proficiency in their class work. One large company offers a scholarship for annual competition among the apprentices, the one showing the greatest proficiency in the evening classes being given one or two years' tuition in college or in the day classes of a technical school.

Several American firms have followed this example to a great extent, notably the large electrical companies, and the results have been so uniformly satisfactory that many extensions of the system are being contemplated.

In Canada, however, this plan is practically untried. The apprentices are generally of the class of young men who are anxious to perfect their knowledge, a fact which is shown by the success attending the efforts of the Y.M.C.A. in various cities to provide instruction in such subjects as electricity and mechanical drawing. Our Canadian employers should encourage this desire, and should from the outset regard the apprentice as a student merely, and not a workman from whom profitahle work is to be expected immediately. When general managers and superintendents hegin to take a more active interest in their apprentices they will see a rapid decline of the tendency to jump apprenticeship.

CANADIAN RAILWAYS TO BE ELECTRIC.

As regards the future of electricity in Canada in connection with railroads a dic has heen cast in its favor by the recommendation of Mr. Cecil B. Smith, chairman of the Temiskaming and Northern Ontario Railway Commission, to equip the first section of the Temiskaming Railway, 100 miles, from North Bay to New Liskeard electrically. Mr. Smith has just returned from Europe, where he made a deep study of the question and only after due consideration was this recommendation made. This is the first instance of electricity being adopted for trunk lines in Canada. It is hut a beginning. What the future holds out is almost beyond conjecture, hut it is an assured fact that the next generation will see hundreds and even thousands of miles of Canada's trunk lines operated by electricity.

IMPORTANT LEGAL DECISION.

A DECISION was recently given by Judge Klein, which will be of interest to shippers of oil who sell at a price "freight prepaid."

A Toronto wholesale paint and oil firm sold a barrel of linseed oil to their customer in the west, and it was shipped in good order, but arrived at destination leaking. The consignee refused to accept or pay for the oil, insisting that the shippers should deliver him the full number of gallons invoiced. The firm who sold the goods contended that they delivered the barrel to the railway company full and in good order, and that if there was leakage it was the fault of rough handling by the carriers, and that the claim for shortage was a matter for the purchaser and the railway company to settle between themselves. The barrel of oil was, in the meantime, lying in the railway freight shed at destination and the contents leaking out. Finally the case was tried in court, and the judge decided that the consignee should pay the full amount of invoice and all costs incurred in the action.

CONDITIONS UNDERLYING THE GROWTH OF CITIES.

COMMENTING on an editorial in the October issue of Canadian Machinery on the recent growth of the city of Hamilton, the Spectator of that city says :

"There is no doubt whatever that the work of the aldermen of the industrial committee, and of the public-spirited gentlemen who have associated themselves with them, has been of great use in attracting industries to this city. These gentlemen have made it easy for investigators to get at the facts—at the reasons why Hamilton should be chosen. But persons who come here to look for sites for extensive and expensive factories are not usually chumps, and to secure their concerns the public-spirited citizens must not only show their goods; but they must show that these are the goods wanted—they must show that Hamilton has actual advantages over any other locality in Canada. The industrial committee and its associates have been able to do this, and hence the rush to Hamilton.

"Hamilton has many advantages as a factory locality over its rivals. Its geographical position at the head of the lake not only gives it water communication; but gives it direct land communication in every direction where land exists. A factory situated at, say

Toronto, or east of it, is obliged to send its products west to Hamilton and then east to the Niagara Peninsula, making many miles of double carriage. A factory situated at, say, Niagara Falls, or anywhere in the neighborhood, would be obliged to send its product west to Hamilton on its way to eastern customers.

"In points of health, market, beauty of surroundings, climate, and all manner of desirable things, Hamilton stands unrivalled. Hamilton's enterprising citizens have done well in drawing attention to her advantages, but once pointed out, these advantages speak for themselves, and the industries continue to drop in frequently.

"But Hamilton's cheif inducement to those looking for manufacturing locations is found in the cheap and plentiful electric power supplied by this city by the Cataract Power Co."

So much for Hamilton.

The point we wished to make clear was that a city's growth depended very largely on the public spiritedness and enterprise of its citizens, and not merely on geographical situation, although the latter is certainly a most important feature. The fact that this progressive spirit in citizens as a municipality is all too rare was what called attention to Hamilton, where, more so than in any other place in Canada, this spirit has been shown. There are many towns in Ontario to-day that might be twice their size if they had applied the same methods that are daily exercised to increase the capacity of a business or manufacturing concern.

Such towns are respectfully requested to wake up.

Toronto has recently taken some more interest in this direction, and there is every reason to believe that she will benefit greatly by it. A good deal of comment has been aroused by Customs Collector White's report that Toronto is growing more rapidly than Montreal, but from the figures published the truth of the statement is borne out.

Every property holder in a town who assists in having a labor employing industry located there is helping himself, and it is surprising that the people in the majority of our small towns have no appreciation of this fact whatever, or if they have it is never put into expression or launched into action.

NO MORE FRANCHISES.

ONE of the most commendable moves yet made by the International Waterways Commission in their worthy and laudable investigations in connection with the water power and water levels of the Great Lakes is their recommendation to the Canadian and United States Governments that no further water power franchises using power affecting the level of the lakes be granted, this to hold until the data now being collected be submitted. The following is the text of the resolution :

"Resolved, that this commission recommends to the Governments of the United States and Canada that such steps as they may regard as necessary be taken to prevent any corporate rights or franchises being granted or renewed by either Federal, State or Provincial authority for the use of the waters of the Niagara River for power or other purposes until this commission is able to collect the information necessary to enable it to report fully upon the conditions and uses of these waters to the respective Governments of the United States and Canada. (Signed) J. P. Mabee, chairman Canadian section ; O. H. Ernst, chairman American section."

"Resolved, that in the opinion of this commission no further rights or franchises should be granted or conferred regarding the uses or diversions of the water flowing out of Lake Superior by either the Governments of the United States or Canada until all data and information are in the hands of the commission that may be necessary to enable it to make suggestions for regulating the excess of these waters, or that if such rights or privileges be granted they be subject to any regulations that may be adopted by both Governments. (Signed) O. E. Ernst, chairman American section ; J. P. Mabee, chairman Canadian section."

These should receive the approval of all interested in the industrial and commercial advancement of both countries, as the harboring of one of the greatest assets we possess means everything to the future manufacturing interests in this country.

TO MAKE SMALL TOOLS.

EVIDENCE of the growing importance of the machinery trade and the machine tools and supplies business in Canada has had further exemplification since our last issue, other firms having realized the best position to capture the Canadian market is by building a factory. The Pratt & Whitney Co., of New York, have recently established a plant in Dundas for the manufacture of their full line of small tools, drill cutters, dies, etc., etc. The building is a modern structure and the power plant is already in place. Machinery equipment is being prepared at Hartford and will be sent here and operations begun immediately. The plant will also include a department for the manufacture of a full line of twist drills and an elaborate equipment of special machinery will be installed for this purpose. The machinery and machine tool trade in Canada has received considerable attention from the additions already made to it this Fall. The fact of these United States firms coming into Canada for the purpose of manufacture is but further evidence of the faith placed in Canada's future and a recognition of the importance of the machinery trade.

CHILDISH TAXATION.

TAXES imposed by one Province against the commercial travelers of other Provinces is national childishness. Canada is old enough and is certainly big enough to discard the swaddling clothes of provincialism in such matters.

The British constitution in which the British North American Provinces were wrapped at Confederation specifically declared that it was ultra vires for the Provinces to levy customs duties against each other's products.

In the strict letter of the law none of the Provinces have essayed to do this, but in spirit some of them are grievous transgressors.

We do not want provincialism in this country. We want nationalism. The Civil War killed provincialism in the United States. And we now want some powerful force to kill it in Canada. The Federal Government has the power but it lacks the inclination.

Practical Mechanics

BY W. H. RAEBURN

Article II. A descriptive discussion of an important subject, simply and clearly stated. Every article of this series should be read and studied by all readers of Canadian Machinery. They are practical and helpful.

Friction.

WHY do we oil machinery? Because there is less friction between metal and oil than between two metal surfaces. Lubrication interposes between two surfaces a thin film of oil more or less continuous, and

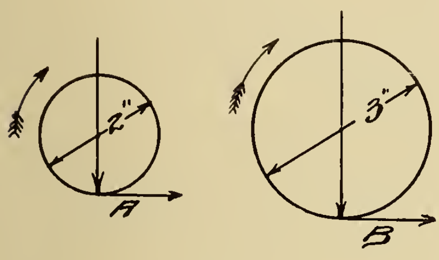


Fig. 1

it is the maintainence of this film as unbroken as possible that constitutes good lubrication, due regard being given, of course, to the quality of the oil.

No one hestiates in believing that the smoother two surfaces are the less friction there will be when they are moved over each other.

We shall deviate here from the usual practice of enunciating the laws of friction, as so many theorems to be committed to memory, without connection, as should be, with actual observations.

Let us look around the machine shop for our lesson. A lathe carriage is moved along the bed by means of a hand wheel; in the case of small lathes the hand wheel is on the same shaft as the pinion which engages with the rack secured to the bed, but in the large lathes it is necessary to interpose between the hand wheel and pinion a pair of wheels—gear and pinion—io order to move the carriage with ease.

Assume that the carriage weighs 600 pounds; it rests on the bed, being kept from lifting by strips or gibs, and, although surfaces are smooth, there might be a frictional resistance of 15 per cent. Thus, if we desired to move the saddle by exerting a direct pull or thrust on it, the force necessary would be $600 \times .15 = 90$ pounds. Lay a weight of 300 pounds on the saddle, as is done in a certain class of lathe work. How much more effort on the hand wheel is necessary in order to move the carriage and weight? If we had the means of measuring the force—a spring balance will suffice—we would find that it now takes $1\frac{1}{2}$ times what it did before we put the 300 pounds on the saddle: $600 + 300 = 900$ and $900 = 1\frac{1}{2}$ times 600.

We learn from this that frictional resistence is in direct proportion to the pressure exerted on the surfaces in contact. There is not much misunderstanding on this point, but we pass on to another side of the question which is not clear to all mechanics. We have two journals, one 3 in., the other 2 in., diameter, each 6 in. long, and each loaded with a pressure of 1,000 pounds; in which case is there the most friction? Many will answer: in the large journal. Why? Because there is the greater surface in contact. We learned from the lathe carriage that friction is in proportion to the weight, and yet here is a case where we say that the same load, 1,000 pounds, produces greater friction in one case than in another, according to the extent of the surface

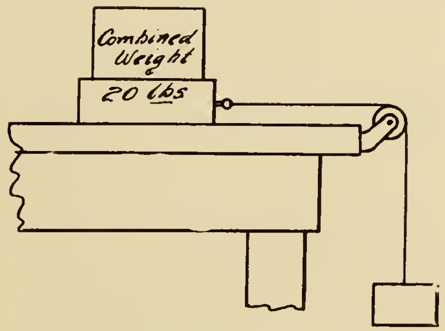


Fig. 2

in contact. If the 3 in. journal were only 4 in. long there would be the same area in contact in both cases—12 sq. ins. In calculating bearing areas of shafts, the projected area, as it is called, the diameter multiplied by the length of bearing is taken. Some would now say that friction would be identical in the two cases, while others, perhaps, more observant or experienced, would adhere to the opinion that there is more friction in the case of the larger journal. Those in the latter class are both right and wrong. We must distinguish between power lost on account of friction and friction itself. It will certainly take more effort to rotate the larger shaft than the smaller one, no matter what the lengths of the journals are, and we must endeavor to explain why this is.

In Fig. 1 the two shafts are represented by end views, and arrows indicate the directions of rotation and pressure. As it is desired to rotate the shafts clockwise, friction tends to prevent this movement by acting as indicated by arrows at A and B.

Let the coefficient of friction be .1, the resistance at A and B will then be $1000 \times .1 = 100$ pounds; observe that there is the same resistance in both cases, but we must look into the matter still further.

We know from early experiences the effect of leverage, and that is just what we must take into account here. In the case of the 3 in. shaft the retarding force acts at a leverage from the centre of the shaft of $1\frac{1}{2}$ in., while in the case of the 2 in. shaft the leverage is only 1 in. We revolve the 3 in. shaft one revolution, and in doing so a resistance of 100 pounds is overcome through $3 \times 3.1416 = 9.4248$ inches, or .7855 feet, so that $100 \times .7854 = 78.54$ foot pounds of work are lost in overcoming friction during every revolution of the shaft. If the number of revolutions per minute were 150, the total work lost in that time would be $78.54 \times 150 = 11781$ foot pounds, and

$$\frac{11781}{33000} = .357 \text{ horse power.}$$

Calculating the loss of power from friction in the case of the 2 in. shaft will show a result just 2-3 of this, as will be readily understood. Why, then, do we make journals as large as we do? Beeause there must be material enough in the shaft to resist the bending and twisting loads that are imposed on it. We see from the foregoing how it is possible to have such a large proportion of power lost in machines where loads are great. The use of roller or ball bearings does much to overcome

Fig. 3.

these losses, because there is not then the sliding or rubbing action between two surfaces. The design and construction of these bearings has been studied closely by engineers and manufacturers, and there are to be found today some excellent examples of how

frictional losses can be reduced to a minimum by the use of roller or ball bearings. There are, of course, some poorly designed bearings in which the rollers tend to bind and create friction, but in the best class are those in which it is claimed that friction is reduced to $\frac{1}{4}$ of 1 per cent. The reader can experiment at a trifling cost with such simple apparatus as shown in Fig. 2. A block of wood 5 in. × 2 in. × 1 in. is loaded by putting a weight of 20 pounds in it, and is made to slide on a smooth board or table, as shown. It will take about $6\frac{3}{4}$ pounds to cause motion, so we may say that the coefficient of friction is $\frac{6\frac{3}{4}}{20}$ = about $\frac{1}{3}$.

By experimenting with different surfaces a table of coefficients can be made, and such will have far more value than so many figures merely committed to memory from a book.

Another thing one simple apparatus will show us: Place the block with its wide face down, thus having 10 sq. ins. of surface in contact, and find the pull necessary. Then place it with the narrow face down, and what do we find, with only half the former surface in contact? Exactly the same pull is necessary. Friction is independent of the amount of surface in contact.

We generally desire to reduce friction to a minimum, and to that end use a lubricant, but there are cases where getting rid of the lubricant in order to allow friction to act is the problem.

Eight years ago the writer introduced the pulley shown in Fig. 3 for use on high speed machinery. When a belt is traveling at the rate of 6,000 ft. per minute there is carried around the pulley between its surface and the belt a thin film or layer of air, which acts as a lubricant, preventing proper contact between belt and pulley, and thus reducing the power transmitted. The grooves on the pulley face afford space for the air to be forced into and overcome the trouble in a marked degree. This pulley was applied to wood working machinery in 1897, by the Cowan Co., of Galt, who have since used it extensively, they being the first in Canada to adopt an anti-pneumatic pulley. There were sceptics at first, and we shall relate briefly how one was convinced of his error. He contended that cutting away so much of the pulley face surface would lessen the grip of the belt. Two pulleys of the same diameter, one smooth and the other groved, were held securely, and a piece of belt weighted at both ends hung over the smooth one; the weight at one end of the belt was gradually increased until there was a very slow motion of the belt. This was repeated with the grooved pulley, and the weights were found to be identical in both cases, proving, as our sliding block did, that the amount of surface in contact does not affect friction. There is this exception, that if the surfaces are very small or very large, a difference is noticeable, but such is probably due, in the case of small surfaces, to slight crushing, and in the latter to lack of truth of the two surfaces.

We know that driving by means of a belt is not so effective when the two pulleys vary much in diameter as when they are nearly equal, and the general idea is that the lack of contact on the small pulley makes the difference. This would conflict with the law we have sought to prove, but there is an explanation that comes from another source altogether, and which we hope to give at some future date.

Practical Questions and Answers

Potential and Kinetic Energy

Ques.—What is meant by "potential energy" and "kinetic energy," as often spoken of in mechanical problems.

Ans.—Potential energy, as the term implies, is the energy that is stored up in matter, and a body of any kind possesses potential energy in virtue of its position or its properties. For instance, a weight suspended in space in any way has potential energy, since if the support be removed the weight will fall under the influence of gravity, and in falling will generate kinetic energy. An enclosed body of gas also possesses potential energy, since in virtue of its expansive force it will do work against an external force, and in doing that work will generate kinetic energy. The case of the weight is, however, the simpler example. The amount of potential energy possessed by the weight depends upon its mass and the distance above the ground. That mass, falling through the distance from its initial position to the ground, will generate a certain amount of kinetic energy, depending upon the mass and the distance. Thus, both the potential energy and the kinetic energy depend upon the same conditions, and thus a suitable definition of potential energy would be: A measure of the ability of a body to produce kinetic energy.

The kinetic energy of a body at any given instant is a measure of the ability of that body to do work at that given instant, and depends upon the mass of the body and its velocity at that instant. The kinetic energy is given in foot-pounds by the formula:

K.E. = $\frac{1}{2}$ m u^2, where m = mass of body in matts (a matt = "g" pounds, where g = accelleration of gravity. The value of "g" varies with the altitude and atmospheric pressure, but for ordinary purposes the value "32" is taken), and u = velocity of the body in feet per second.

Problem—What is the kinetic energy developed by a 10-lb. weight in falling through 50 feet?

Solution—The velocity of the weight at the instant of having fallen the 50 feet is given by the formulae:

$$s = \tfrac{1}{2}\, g\, t^2$$

and u=g t, when

s = distance in feet.

g = acc. of gravity.

t = time of falling in seconds.

and u = velocity in feet per sec.

$$50 = \frac{32 \times t^2}{2}$$

$$16t^2 = 50$$

$$t^2 = \frac{50}{16} = 3.125.$$

$$t = 1.767.$$

$$u = 32 \times 1.767 = 56.544 \text{ feet per sec.}$$

$$\text{K.E.} = \frac{m\,u^2}{2} = \frac{10}{32} \times \frac{(56.544)^2}{2}$$

$$= 499.39 \text{ foot pounds.}$$

Problem.—What is the kinetic energy of a cannon ball, at a certain instant, weighing 5 lbs. and traveling at that instant at the rate of 1,000 feet per second?

Solution:

$$\text{K.E.} = \frac{m\,u^2}{2} = \frac{5}{32} \times \frac{(\ 000)^2}{2}$$

$$= 78125 \text{ foot pounds.}$$

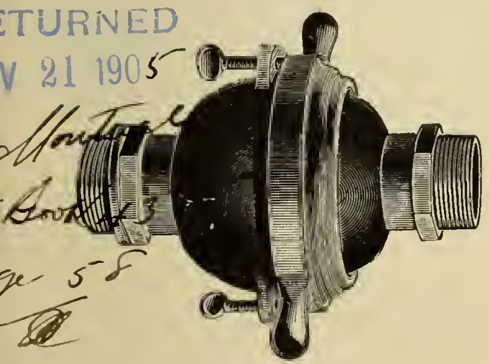
In computing the kinetic energy of a body rotating about an axis, it is necessary to take up a new element, namely, the "moment of inertia," and this will be considered in next month's issue.

Power and Transmission

Steam Gas Electricity Compressed Air Water

RADICAL DEPARTURE IN GAS ENGINE CONSTRUCTION

FOR eight years Mr. A. G. Ronan, 26 Macpherson avenue, Toronto, has made a close study of the gas engine, and during this time has lent his genius in the direction of further improving this now very important prime mover. The result is that Mr. Ronan is about to place on the market a gas engine embodying features so radically different from present day practice as to be almost startling. Probably the most important of these is the fact that he has built a four-cycle gas engine with one valve; all others have two and many three. The second feature of note and probably calling for some explanation is that he has entirely eliminated the carbureter. To accomplish this he has invented an ingenious affair which is a measuring device for allowing the proper amount of gasoline to enter the combustion chamber. While in other engines the air and volatilized gas are mixed before entering the cylinder this new engine has the gasoline, a very minute proportion of it, measured by the petrol metre, drawn directly, while the air is brought in independently. By having an open port at the lower end of the cylinder, a large percentage of burnt gas is expelled in the forward stroke with this arrangement. Mr. Ronan has entirely eliminated the disagreeable odor which is universal with gas engines. For this last feature alone, apart from the radical departures already mentioned, if successful, Mr. Ronan may be looked upon as a world benefactor, and if his engine bears out in practice what is hoped for it it will mark a revolution in gas engine construction. In the next issue of Canadian Machinery further details and cuts will be given of this engine and readers may look for an interesting description of something new in gas engine practice.



Moran Flexible Joint.

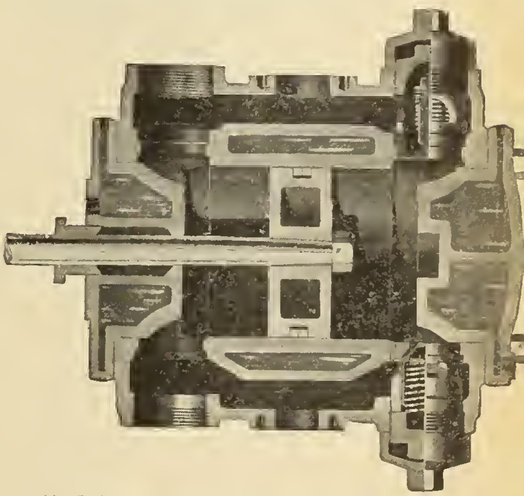
THE MORAN FLEXIBLE JOINT

HEREWITH is shown a cut representing the Moran Flexible Joint made by the Moran Flexible Joint Company, Louisville, Ky., and for whom the Canadian Fairbanks Company, Limited, are sole Canadian agents. As will be seen by the cut, this joint has only three parts, which are all metal, and its life is five times that of any flexible conveyor of oil, gas, steam, air, etc. This joint solves the problem of laying pipe lines under water or across streams, making line easy to lay and allowing it to conform to the bottom of stream, thus relieving it from any strain and making it safe from passing vessels.

The following are a few of the sundry uses where the Moran Flexible Joints are almost indispensable: Pile drivers, coal hoists, steam shovels, rapid unloaders, channelling machines, steam niggers, steam syphons, laundry mangles, veneer driers, expansion joints, in long steam lines, between boiler and engine (also avoiding tremor) and between boiler and drums; for temporary testing lines in large plants, and especially on rock drills, making a flexible pipe line for any desired pressure, thus increasing the capacity and life of drill by being able to properly lubricate it through the all metal pipe line; loading and unloading oil and gasoline steamers or barges, allowing the pipe line to rise and fall with the vessel; loading and unloading tank-cars or tank-wagons with oil or other liquid, also for connecting our barrel-fillers to fill liquids of any gravity; for pneumatic hoists and traveling cranes; for dredging, the Moran Flexible Joint is being used successfully on centrifugal pumps for suction and discharge, up to 24 inches; also on lines running on pontoons, handling oil, rock, gravel, sand and mud. For compressed air, 2,000 pounds pressure, and hydraulic pressure of 3,000 pounds, we make special joints. Being improved by use, the life of the Moran joint is practically unlimited, and because there are no expenses to follow in the way of repairs, frequent renewals, delays, etc., which attend the use of less substantial appliances, its economy is apparent. From three to four joints will give ample flexibility to a pipe line connection drill with boiler, no matter if it be 50 feet long. These joints are carried in stock by the Canadian Fairbanks Company, Limited, who will be glad to give further information to any party interested.

AIR COMPRESSOR PARTS.

SOME of the different features embodied in the air compressors of the Chicago Pneumatic Tool Co. are illustrated herewith. The general designs have been followed only in details vital to exclusive air compression.

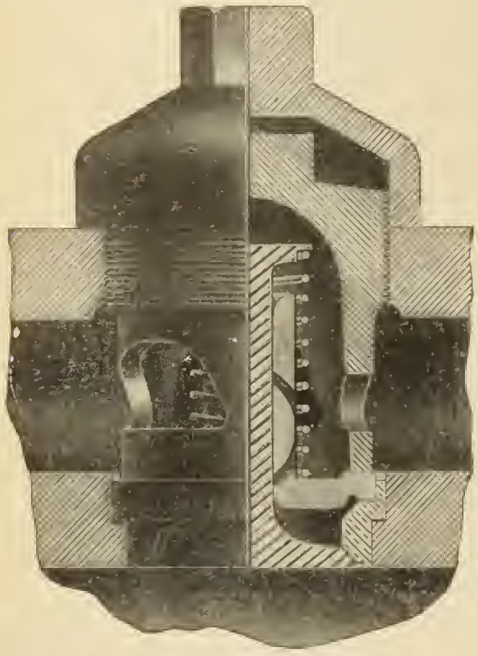


Air Cylinder Section, Showing Piston Construction, Water Jacketing Spaces and Valve Location.

To obtain the best results with an air compressor it must be steam driven, have steam valves designed and adjusted for a minimum steam consumption in the development of this capacity, and must, irrespective of its actuating medium, possess sufficient air valves, thorough water jacketing of air cylinders and heads, and automatic regulation.

The new pattern, Type G compressors, are designed to meet the growing demand for simple, efficient, compact, and withal moderate-priced compressors, and represent the latest development in

this class of machine. The frame is of box section design, with large factor of safety to withstand the strains when working at maximum load; it is graceful in outline, with bored cross-head guide, and enclosed provisions for catching and removing drip from bearings and stuffing boxes. Steam valves on cylinders under 12 inches in diameter are of plain slide type, accurately scraped to seat



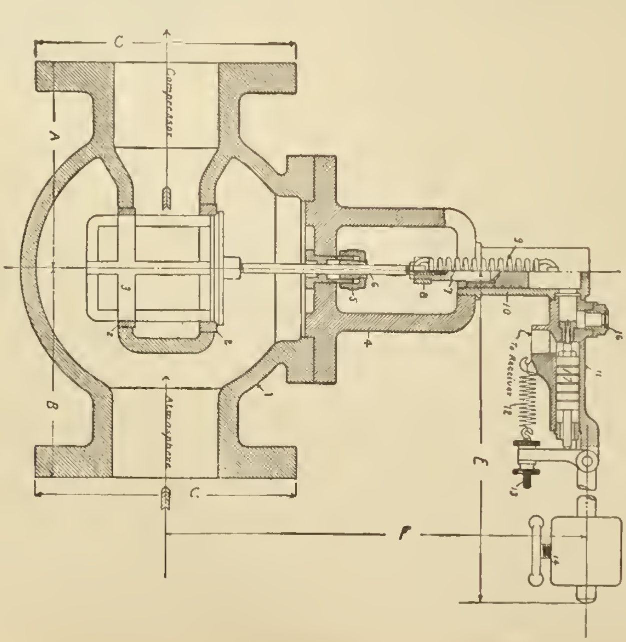
Inlet Valve for Original Type of Compressors.

and securely fastened to rod. Cylinders 12 inches in diameter and larger are furnished with Meyer adjustable cut-off valves and gear. The air inlet and discharge valves are of the poppet type, made from high-grade steel, having removable seats and guides, easily renewed or repaired, and thoroughly guarded from entering cylinder in case of breakage. They are placed radially in cylinder, making them readily accessible, insuring accurate seating, and reducing wear to a minimum. The air cylinder and its heads are completely water jacketed, with thorough circulation of water, affording equal cooling at all points. A pressure regulating governor is provided to automatically control the operation of the compressor in accordance with the demand for air, working in connection with a speed governor for regulating the speed of the

Unloading Device.

engine. An unloading device is provided to relieve the compressor of all load when the desired air pressure is obtained, and automatically cause it to resume delivery when the storage pressure becomes reduced.

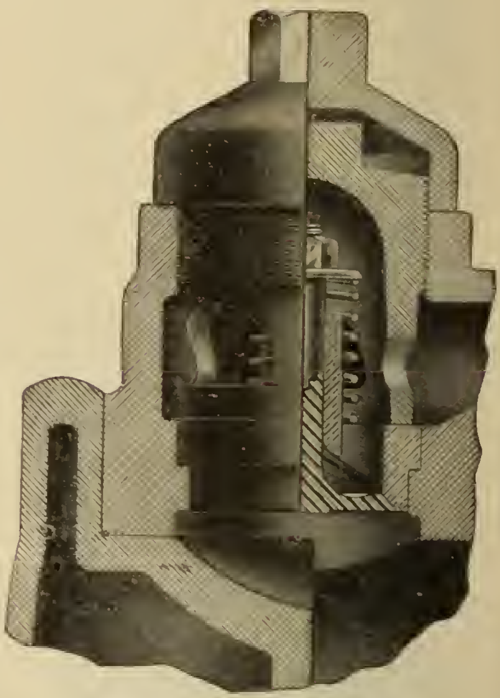
These compressors are submitted to a working test before shipment, and although designed primarily to supply compressed air power for operating pneumatic tools in railroad shops, machine shops, foundries, shipyards and stoneyards, they are equally suitable for actuating rock drills, coal cutters and other machinery in mines, tunnels, and quarries, pumping water by the air-lift system, and for every other purpose to which compressed air is applied.



Unloader for Duplex and Compound Belt Compressors.

STEEL PLATE FOR FANS.

Up to about 1880, fan or blower housings were almost universally of cast iron, built up out of separate flanged segments bolted together. Obviously every special fan required a special set of patterns. With the increased demand for large fans this method of construction soon became inadequate, and B. F. Sturtevant, the well-known blower manufacturer, resorted to steel plate for the entire



Inlet Valve for Type G Compressors.

housing. This simple change practically revolutionized fan manufacture, for the whole structure, stiffened by steel angles and beams, easily constructed in conformance to any given design, and readily portable, was fully as efficient as the cast iron housing, while much less expensive.

In the smaller sizes the steel plate planing mill exhauster was an important result of this change, and it is now the established construction for this type of fan.

Larger fans naturally demanded direct connected engines for their propulsion, and the introduction of the three-quarter housing fans, with the lower portion of their shape formed in the brick foundation, required the use of the horizontal type of engine. Thus was brought out the Sturtevant horizontal engine of a design suitable for driving the fan either by direct connection or by belt from a more distant location. Evidently the engine that could

successfully withstand the continuous usage at high speed that is required of a fan engine must be adapted for general work. As a natural consequence, these engines immediately found a place in the open market in competition with other high-grade engines.

ORE UNLOADERS FOR THE GREAT LAKES.

ONE of the most interesting and notable examples of the remarkable advance in modern industrial appliances is that to be found in the ore unloading equipment of the Great Lakes. The ore unloading facilities of the Great Lakes are far in advance of those in any other part of the world, and at not even the largest ocean ports is reached the marvelous speed of unloading and handling which has been obtained at modern lake docks. A notable type of the modern equipment employed for the purpose, in fact the one holding the world's record for fast ore unloading, is the Hulett automatic ore unloader, invented by Mr. Geo. H. Hulett, third vice-president of the Wellman-Seaver-Morgan Company, Cleveland, Ohio, who are sole builders of the machines.

The general view herewith shows the latest installation of these unloaders, namely two electrically operated machines at the United States Steel Corporation's National Tube Co.'s docks. Lorain, Ohio. An idea of the heavy service required of these machines may be gathered from the fact that they rapidly handle an enormous grab bucket which, when open, has a spread of over 18 feet, and which automatically digs and conveys from the hatches of the boat ten gross tons of iron ore at a load. This bucket when open can by telescopic motion be extended still farther, so as to reach more than halfway from the centre of hatch to hatch. It is carried at the lower end of a vertical dependent leg suspended from a long pivoted walking beam, which is carried on a carriage or trolley which travels back and forth on the girders of the machine. The operator who controls all the motions of the bucket rides at the lower end of the leg directly above the bucket. By means of hoisting mechanism the walking beam is made to oscillate up and down, carrying the bucket down into the hold of the boat and up again above the dock. The leg carrying the bucket is mounted on rotating trunnions in the walking beam so that it can rotate in a circle when operating in the hold of the vessel, permitting the bucket to reach out in all directions. It also travels lengthwise of the hatch, to the sides of the boat, consequently the operator is able to reach almost the entire cargo.

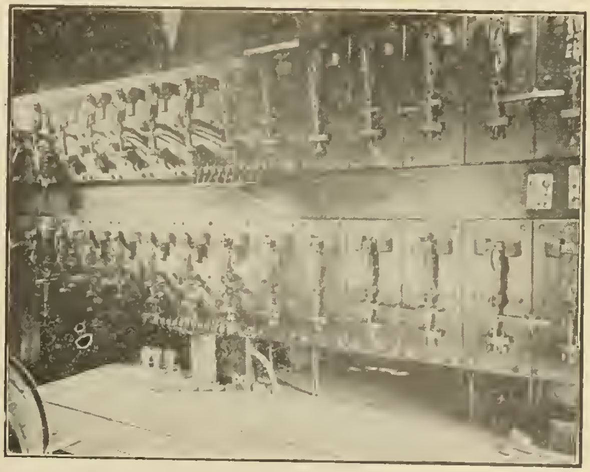


Fig. 2.—Master Controllers for Hoist and Trolley Travel Motions.

Fig. 1.—General View of Hulett Unloaders on Locks of U. S. Steel Corporation Plant at Lorain, O.

The controlling devices for machines of this type are in all cases specially constructed to meet the conditions. The controllers, proper, for this unloader consist of a number of magnetically operated clapper switches, which cut resistance in and out of the motor circuits. The switches are operated by solenoids placed on the back of the switch-panel. The main contact of each switch is a heavy laminated copper brush reinforced with a yellow brass contact, the final break being taken between carbon contacts, and the arc is quickly ruptured by a powerful magnetic blow-out. The switches are controlled by small master switches located in the operators' cabs. As the solenoids of the switches require but few amperes, the wires connecting the master switch with the controller proper are of very small size.

A general view of the unloading apparatus is shown in Fig. 1. In Fig. 2 are shown the magnetic controllers which control the movement of the bucket in and out of the boat and the raising and lowering of this bucket. Fig. 3 shows the magnetic switch controllers operating the bucket-car haulage motor. The ore is dumped from the bucket into a car which is pulled up the incline by a motor located in the machinery house underneath the trolley. The master controller for operating the bucket rotation

motor is shown in Fig. 4. This motion operates so easily that the controller is small and requires but few stops.

This type of control was designed, developed and built by the Electric Controller & Supply Co. of Cleveland, Ohio, who also manufactured and supplied all magnetic solenoids for hand brakes and all other electrical details.

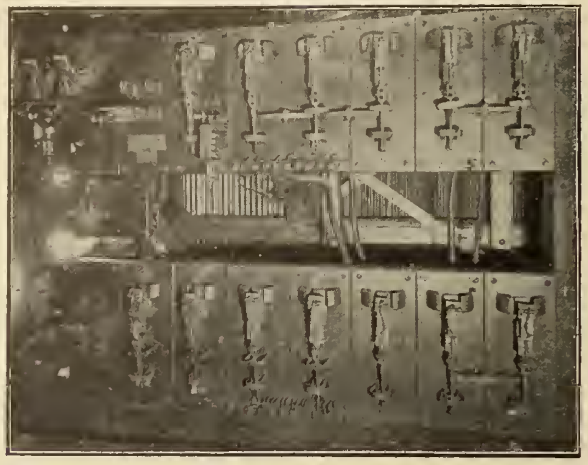


Fig. 3.—Magnetic Controller for Bucket Car Motors.

A WEEK'S BUSINESS IN STEAM TURBINES.

DURING the week ending September 28th, 1905, the Westinghouse Companies of East Pittsburg, Pa., received orders from the Toledo Gas, Electric & Heating Co., Toledo, Ohio, for two 1,000 k.w. turbo-generator sets, the Pennsylvania Railroad Co. for four 500 k.w. turbo-generator sets; the Water, Light & Gas Co., of Hutchinson, Kan., for two 500 k.w. turbo-generator sets; and the Solvay Process Co., of Syracuse, N.Y., for one 500 k.w. turbo-generator set. Each turbine will be of the type known as the multiple expansion parallel flow, with an overload capacity when running condensing of at least 50 per cent., and the alterating current generators will be of the turbo type with rotating fields.

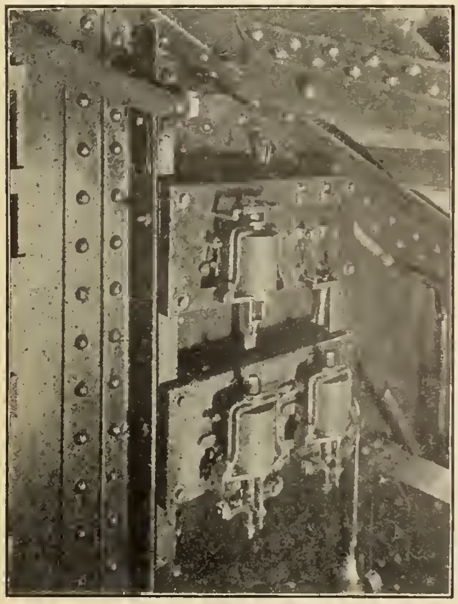


Fig. 4.—Magnetic Controller for Bucket,Rotation Motor.

The turbines for the Toledo Gas, Electric & Heating Co. will be adapted for driving a direct connected 60 cycle generator running at 1,800 r.p.m., and giving 7,200 alternations per minute, each being capable of developing 1,500 r.h.p. when operating at 1,800 r.p.m. with dry saturated steam at the throttle of 150 pounds pressure and 28 in. vacuum in the exhaust pipe. They will be provided with secondary governor valves by means of which 50 per cent. overload may be developed, or full load developed when operating with condenser. The generators will have four poles and will deliver three phase current at 4,400—4,800 volts. The generator frames will be of the enclosed type with the latest and most improved system of ventilation.

The two 500 k.w. turbines for the Water, Light & Gas Co. will operate with dry saturated steam at the throttle of 150 pounds pressure and 28 in. vacuum. The 60 cycle generators will deliver two-phase current at 2,200 volts.

The 500 k.w. steam turbine for the Solvay Process Co. will operate with dry saturated steam at the throttle of 125 pounds gauge pressure and 28 in. vacuum. The 60 cycle direct connected turbo generator will deliver two-phase current at 440 volts. This company already has in operation a number of Westinghouse steam and gas engines, in addition to 3,600 h.p. in Roney mechanical stokers. Westinghouse apparatus is also installed in the Detroit plant of this company.

DON'TS FOR BOILERS USERS.

A BOILER manufacturing firm in England incorporates in its catalogue some practical don'ts for those handling boilers. They are:

Don't fix sectional boilers to poor chimneys, as they require a good draught. Don't let the ashes accumulate under the fire-bars. Don't let the soot remain in the boiler-flues. Don't use small slack, as it is not economical. Don't put the new fuel towards the back of the boiler when firing, but near the front. Don't let the fire-bars become uncovered at the back. Don't leave the firing-door open. Don't let the fire out during frost. Don't light a fire in the boiler when the pipes are frozen. Don't fix a boiler without a safety-valve. Don't allow hot water to be drawn off from the boiler. Don't fix the cold water supply pipe direct into the boiler. Don't empty the apparatus during the Summer months. Don't screw sectional boilers up too tightly. Don't light a fire in a new boiler before the bolts have been slacked back. Don't fix a boiler without covering it with non-conducting material. Don't try to make the boiler sections meet, as they are not intended to. Don't fix a boiler more than two sizes larger than is necessary for the work. Don't fix a boiler to work to its full listed capacity. Don't be content with an old pattern boiler, when a modern one will save its cost in one or two years.

THE MODEL FLANGE CLAMP.

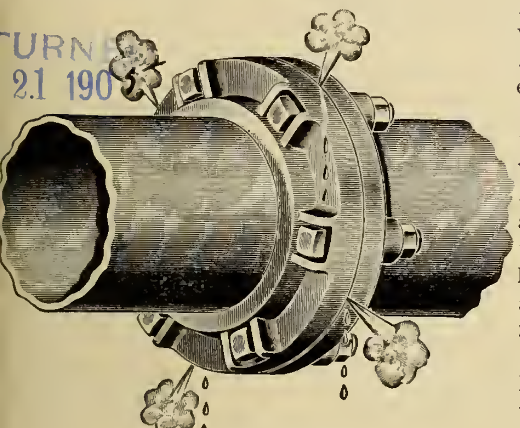
IT often happens that a leak occurs between pipe flanges at the most inopportune time, and when it is impossible to shut down and renew the packing. There are also many times

Flange Clamp, Sectional View.

when it is not practicable to break the joint, as it may necessitate a large expense. Nearly every engineer has experienced such difficulties, and they will

appreciate the new flange clamp manufactured by James McCrea & Co., 67 West Washington street, Chicago.

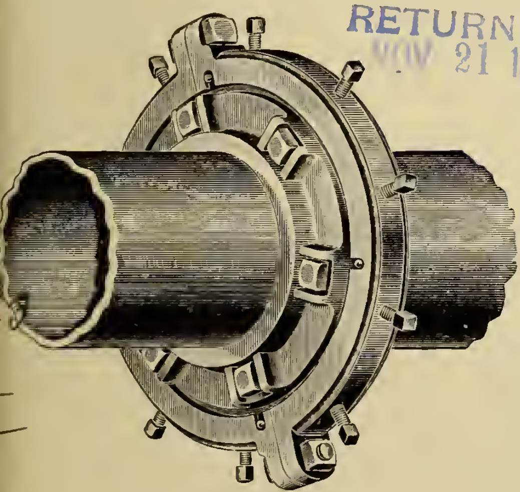
This clamp can be attached in a few minutes with the pressure on the pipe, and will successfully repair the leak until it is convenient or advisable to renew other packings on the line, be it



Leak in Steam Pipe.

months or years later, when the clamp can be removed and saved for a future emergency.

By referring to the cuts any mechanic will thoroughly understand the mechanism used. The clamp consists of an outer ring made in two sections, in which the compression screws are placed; an inner or compression ring made in four sections, with a lug on each section to correspond with a slot in outer ring, thus assuring no displacement while attaching, and we also furnish the gasket, which is placed around the flanges over the leak. By this means it



Pipe With Flange Attached.

is possible to get any desired pressure, and it will be equal at every point. Should, by any reason, the leak appear around the bolts holding the flanges together, it is an easy matter to pack around the bolt with a little hemp soaked in red or white lead, and the use of a common iron washer.

At the Noon Hour

Smoke vs. Fire.

An old-time Scotch foreman, by the name of Aundy Kloch, had in his employ one of his own kin, a Scotch molder by the name of Dunes. Dunes was very fond of his pipe, and was continually smoking, to which Aundy, the boss, very much objected; especially during working hours.

Dunes had some trouble one day getting a draw on his pipe (which was of the corn-cob variety), and was continually ramming a vent wire down the stem and putting in a new charge of tobacco, this process being kept up until Mr. Dunes got behind in his day's work; for at the end of the day he was just one flask shy.

Aundy, the boss, could stand it no longer. So he says: "Mr. Dunes, Oi would loike to shpake a word till yez."

"Oi Aundy, make it a dozen while you're at it."

"Ye air very fond of shmoking, Mr. Dunes?"

"Yis, Aundy."

"And yez shmoked all morning, Mr. Dunes?"

"Yis, Aundy."

"And yez shmoked all noon hour, Mr. Dunes?"

"Yis, Aundy."

"And yez shmoked all afternoon, Mr. Dunes?"

"Yis, Aundy."

"And yez shmoked when the blast was on, Mr. Dunes?"

"Yis, Aundy."

"And yer short one flask in your day's work, Mr. Dunes?"

"Yis, Aundy."

"Well, where there is so durn much smoke as all that, Mr. Dunes, there must be fire, so I fire yez."

A Shop Joke.

An old machinist who has traveled much, who has handled his time check from a good many shops and who has therefore a knowledge of machinists and their ways, tells the following incident of the last large shops where he worked.

A certain machinist who generally had large work on his lathe devised a neat little scheme of making good use of the time (sometimes several hours) which intervened between the time of starting and finishing a cut on his work. He arranged a place between his lathe and an adjoining planer where he could snooze without much fear of the foreman seeing him. Before retiring he would arrange a board on the lathe bed so that as the tool left the work at the end of the cut the apron would dislodge one end of the board and allow it to fall on him thus waking him at the right time. This scheme worked fine until one time during his sleeping hours some of his fellow machinists, thinking the repetition of this too much of a good thing, put a pail of cold water on the board.

The narrator says that that machinist broke off the habit of sleeping during working hours from that time.

The Value of Knowledge.

The machinery was out of order at one of the cotton mills and several machinists were sent for to repair it, and all declared that it could not be repaired and that a new engine would have to replace it. An Irishman employed about the place asked permission to try and fix the engine and they consented. He hammered it a little, put in a few screws and finally got it working all right.

They asked him how much he was going to charge and he sent in his bill for $200.50. They asked him why he had put the 50 cents in and he replied: "The fifty cents was for doing the work and the $200 was for knowing how."

In the Machine Shop.

Visitor (to apprentice)—"Could you tell me who that man is talking to the operator of the turret lathe, and what he does?"

Apprentice (instantly)—"O! he don't do nothin'. He is the foreman."

No Royal Road.

A young man once said to Thomas A. Edison, the inventor: "Mr. Edison, don't you believe that genius is inspiration?"

"No," replied Edison; "genius is perspiration."—Life.

UNIQUE MACHINERY.

The Pedlar People of Oshawa and Montreal have this week contracted in New York for the early delivery of the extensive plant required in the manufacture of the new fireproofing commodities which they intend to make. Their purchases comprise probably the heaviest and most expensive machinery of the kind ever brought into Canada.

Arrangements have been made for the delivery of these machines at the Oshawa factory within thirty days, and the product will be on the market before the first of the year. A comparative statement of the first costs of a fireproof partition manufactured from steel as against one made from porous terra cotta will appear in "Pedlar Talks" within the next few weeks, and will be of certain interest to our readers.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

STEAM TENSION BAND MILL.

In the cut shown herewith is illustrated a new steam tension band mill, manufactured by the William Hamilton Manufacturing Co., Limited, Peterboro. It is designed for either single or double cutting, and has been pronounced by mill men to be one of the simplest and best designed band mills yet placed on the market. Heret fore it has been the universal custom to maintain the strain on the saw by the use of some system of levers and weights, which is a clumsy and makeshift device at the best. It is well known that the action of a weight—especially one as heavy as must be used in the tension mechanism of a band mill—is necessarily slow on account of its inertia. Every practical mill man will admit that in order to get the best results in sawing, the tension device should be very sensitive and capable of responding instantly to the varying demands of the work. As it is manifestly impossible for any form of weight tension to meet these requirements, we have substituted for the weight a direct acting steam cylinder, so arranged that the strain on the saw can be varied at will from 3,500 pounds up to any required amount. Automatic means are provided to prevent damage in case saw runs off the wheels or breaks, and ample provision is also made to enable a practically equable strain to be carried on the saw under varying boiler pressures. These features, in combination with our counter-balanced upper wheel, form the simplest, most practical and by all odds the most sensitive saw straining mechanism ever placed on a band mill.

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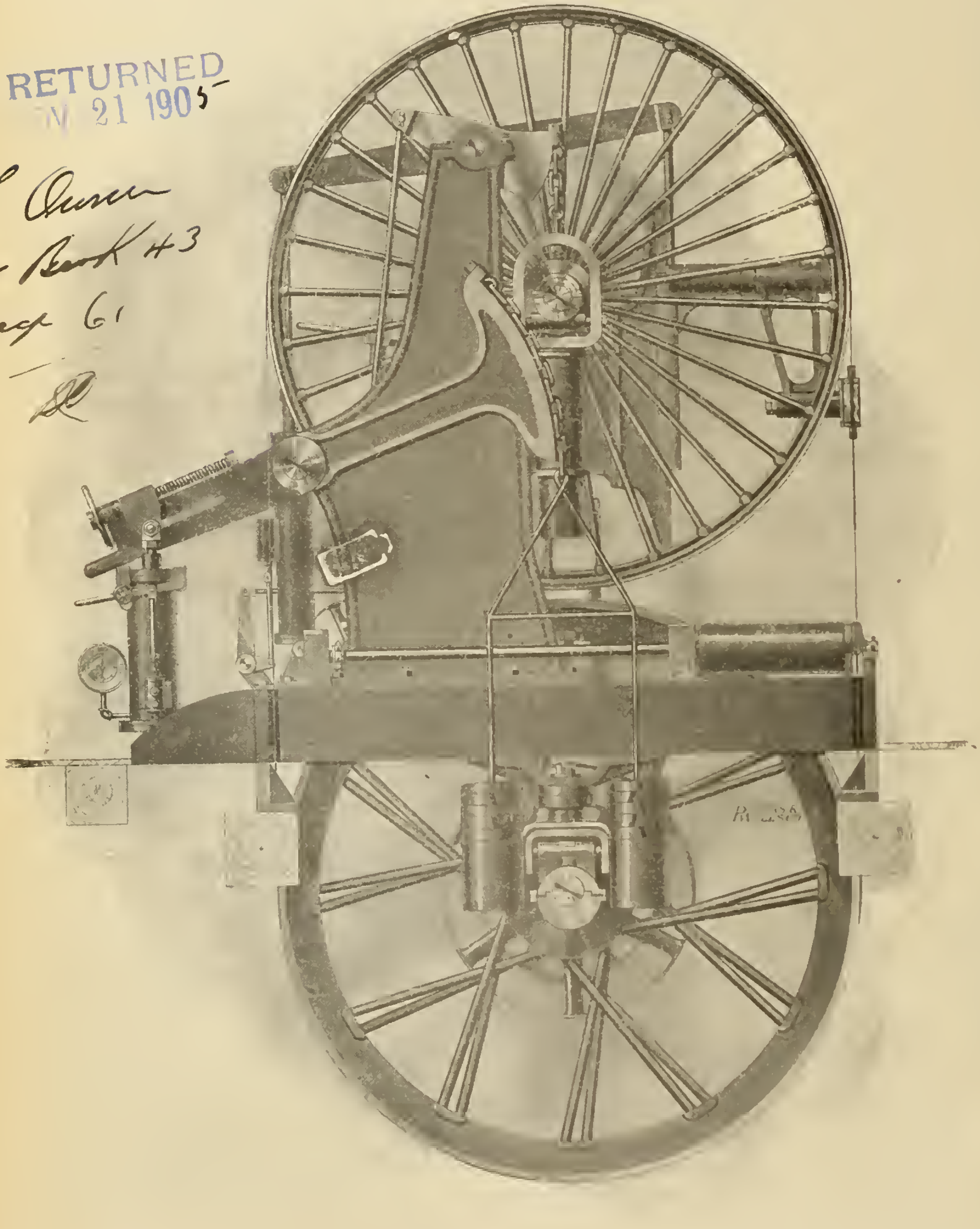


Steam Tension Band Mill.

It will be evident to anyone familiar with the use of steam that the action of this saw straining device must be instantaneous. Consequently the saw will always be kept in proper tension to do its best work. In changing saws all the time required is what it actually takes to handle the saws, as on this mill the strain can be taken off the saw, the top wheel lowered and raised again throughout its whole range of movement and the strain put on again, all in less than ten seconds. Saws can be changed from longest to shortest or vice versa, in the same time it takes to change those of the same length. This mill also uses the shortest saw ever put on an 8-foot wheel for sawing logs, namely, 41 feet 3 inches. With this saw the wheels are less than 1 inch apart, and it will cut under the guide a log 3 feet in diameter. Experience has proven that the only satisfactory way of steadying and holding a band saw in line above the log is to provide a suitable guide which is capable of being placed down near the cut, as it is impossible in practice to get the top wheel down close enough to the log to serve all the purposes of a guide. A patented freely swinging guide is so constructed that it will swing back and up out of the way if struck by a log from either direction. In case of large logs the guide can be instantly swung back by hand and moved entirely out of the way so that all the space between the top wheel and head block can be utilized for deep cuts. With the guide moved out of the way a 4-foot log can be cut with the shortest saw. The guide can be replaced in three seconds. The jaws of both top and bottom guides are hinged so that they may be spread apart without loss of time in changing saws. The top guide is moved up and down by a steam cylinder located on back part

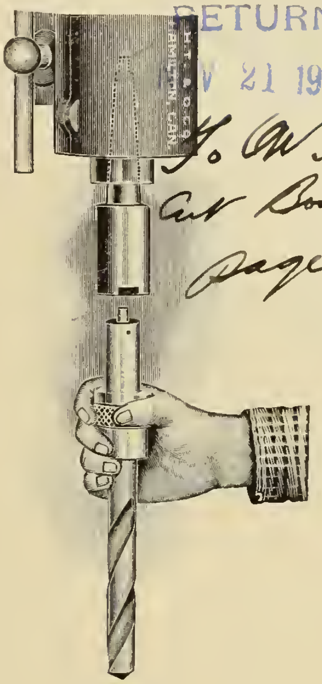
of frame, and so constructed that the piston will be automatically locked in position the instant the valve lever is released. All mechanism for tilting, raising and lowering the top wheel is overhead and entirely out of the sawdust and dirt.

BEAVER CHUCKS.

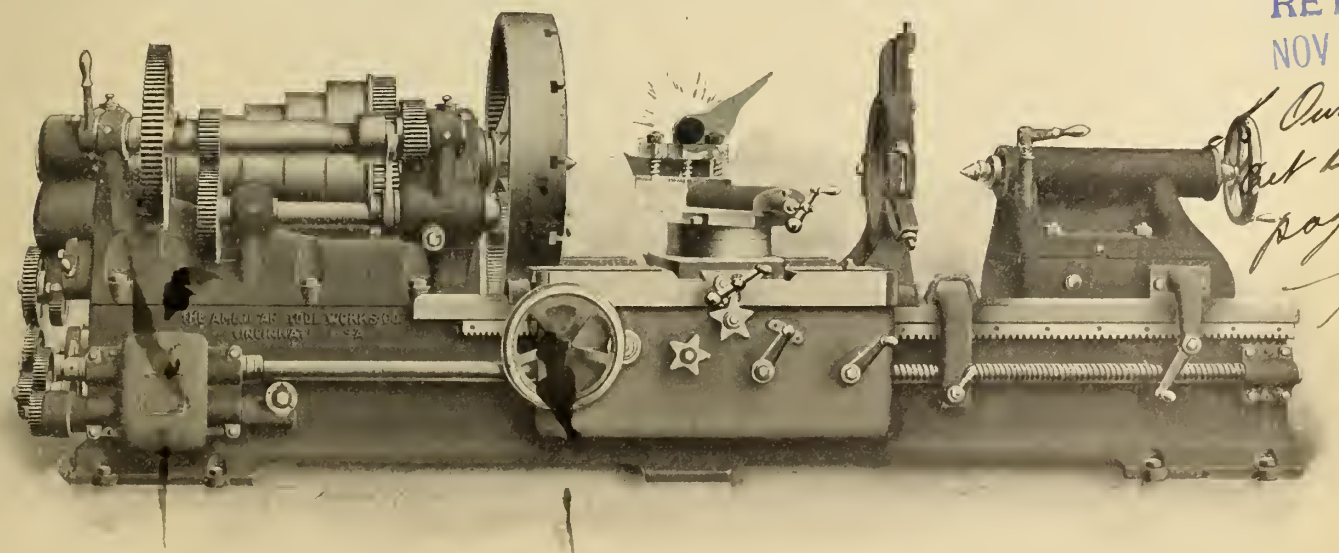
A VERY interesting drill chuck and collet containing drill is shown herewith. It is manufactured by the Hamilton Tool & Optical Co., Hamilton, and is being placed on the market by W. T. Standish, manufacturers' agent, Toronto. It contains several entirely new and original features which commend it to more than a passing notice, and should assure for it a large use among manufacturers, and all others requiring the use of a drill press. For each chuck there are three collets for the different sizes of drill shanks. A special feature of this chuck is for the rapid changing of drills, reamers, counter bores, etc., while the drill press is running. The illustration shows an operatar about to place a collet in the chuck. When inserted it immediately engages the latter, and the positive drive is assured. To remove the collet a slight downward pressure on the knurled collar releases it instantly, while no amount of downward pressure on the drill or the shank will have any effect. Thus, the operator may have in constant use several sizes of drills, the changing of which in his machine requires but an instant. The use of this chuck obviates the use of the hammer or wrench, or any other tool that the machinist might formerly have found handy in removing the drill from the chuck by striking the collar. This chuck will no doubt meet with a good reception from the machinery trade in Canada, and likewise a large measure of success.

36-INCH "AMERICAN" ENGINE LATHE.

RECENT developments in modern shop practice, and the present extensive use of special high-speed tool steels have made the ordinary engine lathe of the past entirely inadequate to the greatly increased duties now imposed upon machine tools, especially lathes. To meet these changed conditions and new demands a line of thoroughly new and improved lathes, which is designated as "American" lathes, has been designed and built, one size of which is herewith described. Their general construction and new and original features make them unequalled as rapid work producers by the most modern and progressive methods. Improved quick change gear mechanism provides thirty-two changes for feeding and thread cutting, the range of threads being from one thread in four inches to sixteen threads per inch including $11\frac{1}{2}$ pipe thread. The feeding range is 6.4 to 92 cuts per inch. The device is operated, even while running, by revolving nut at right of gear box beneath head, which moves a sliding key, of improved construction, engaging two opposed gears, each being one of a cone of gears contained in gear box. The feed or screw inches thus obtained are multiplied through compound gears on quadrant at end of head, it being necessary to change one gear only on quadrant for each additional thread. This arrangement gives flexibility to the screw cutting mechanism, making it possible, through the introduction of certain gears, to cut practically an unlimited range of special worms or threads, either finer or coarser than the range indicated above. Index plates show clearly how to obtain any thread, pitch (inches lead), or feed. Bed is of deep section, exceptionally heavy, of patent drop-V pattern, which gives two inches additional swing, and has cross box girders at short intervals its entire length. This construction gives exceptional rigidity. Bed is further strengthened by rack cast in centre, for engaging pawl of tailstock. Headstock is built with triple gears. It is firmly bolted to bed and is very heavy. Cone has 5 steps, largest 20 inches diameter by $4\frac{3}{4}$ inches face. Spindle is of high carbon special steel, accurately ground, and has hole $2\frac{1}{8}$ inches its entire length. Bearings are of best quality phosphor bronze (not of babbitt metal) with improved oiling facilities, and with means for any necessary adjustments. Triple gears are of slip gear type, readily engaged by rack

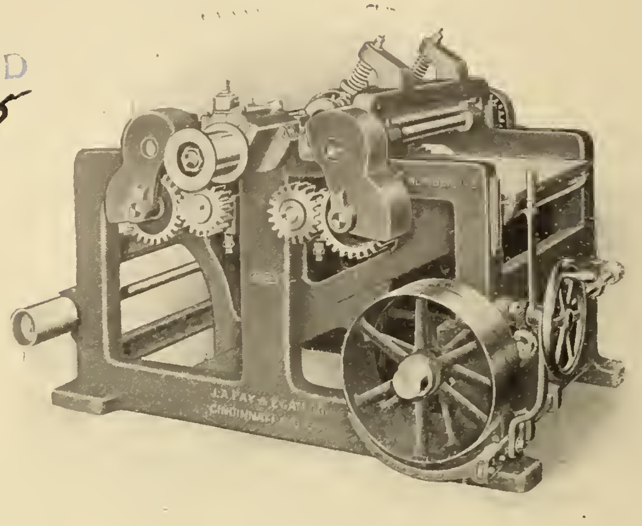


Beaver Chuck.



36 inch American Engine Lathe.

and pinion at front of head. Internal gear is planed integral with face plate and the pinion is cut solid with the shaft. All gears involved are coarse pitch and wide face. Fifteen speeds are obtained in geometrical progression. Ratio of gearing is very high, calculated for great power. Tailstock is strongly proportioned, with large continuous bearings on the ways, and is moved rapidly along the bed by crank and gear. It is provided with set-over feature for turning tapers. Base is rigidly clamped to bed and is further secured against movement by a pawl engaging rack cast in centre of bed. Spindle has exceptionally long travel and is actuated by hand wheel and screw. Carriage is very heavy, especially in the bridge, due to the drop-V bed, and has continuous bearing of 50 inches on the ways. It is gibbed to bed its entire length. Apron is tongued and grooved and firmly bolted to carriage, extending its entire length. It is double, giving all shafts a double bearing. Both longitudinal and cross feeds are reversed, through tumbler plate, from front of the apron, and not at the headstock, as on most lathes. This feature is of special value on long beds, where operator is far removed from head. Half nuts are also controlled by lever on front of apron. All the gears and pinions are steel and of wide face, coarse pitch, cut from the solid with special cutters and bronze bushed where running loose. Bevel pinion is never disengaged, thus avoiding much trouble from breakage. All studs are of crucible steel, hardened and ground. Convenient means for thorough lubrication are provided from the front. Compound rest is fitted with taper gibs in such a manner that no amount of strain will disturb them. Top slide is provided with power angular cross feed, with 13½ inch travel. Mitre gears are steel, planed from the solid. Swivel is graduated and top slide and cross feed screws have micrometer dials. This lathe is a product of the American Tool Works Co., Cincinnati, Ohio, and is in keeping with other high grade lines turned out by them.



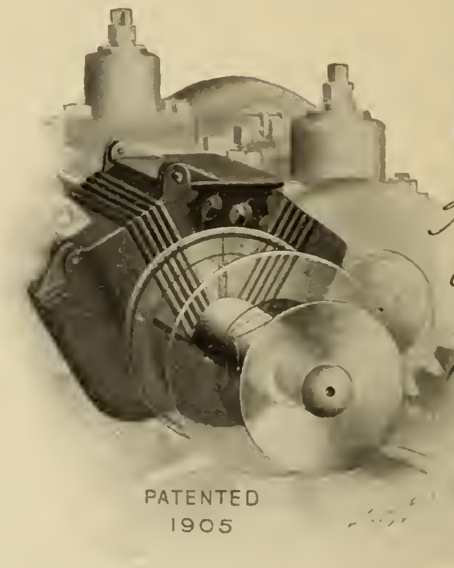
New Cabinet Smoothing Planer.

NEW CABINET SMOOTHING PLAINER.

THIS planer is designed for use in furniture, piano and cabinet factories, or wherever a fine, smooth surface is required. Each of the main features, noticed below, contains late improvements which combine to make this machine a cabinet-smoothing planer of a superior order. In connection with the feed will be noticed the Fay & Egan recently patented sectional feed roll, and in the paragraph on the cylinder is described a novel plan of constructing the journal boxes, whereby all scraping or rebabbitting is done away with.

On this surfacer the heavy table is supported by two long wedges or inclines, which extend almost the entire length of the frame; and, at all times, the places of support are directly underneath the feed rolls and the cutter head. These wedges run in gibbed ways on the base of the machine and are also gibbed to the table itself. By their horizontal movement the table has its vertical adjustment, which is accomplished by two parallel screws, mounted on ball bearings, and operated at the feeding-in end of the machine by hand wheel and bevel gears, shown in illustration. By this arrangement of the table the result is a firm, rigid support for the stock, without any yielding or trembling under the pressure of the upper feed rolls.

The feed mechanism consists of four rolls 5 inches in diameter, all powerfully driven by a system of gearing, used only on Fay & Egan planers. Every gear transmitting the driving power, acts upon the driven gear at a point above and behind the roll's line of contact with the stock. Thus, every roll, in its downward motion, takes firm hold upon the board and there is no tendency anywhere to lift away from it, as is the case with many a planer, and, with some makes of machines where you would least suspect it. A valuable addition to the strength of the feed in this planer is, that all gears are keyed to shafts which run in babbitted bearings; the use of studs with



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X-Ray View, Showing Sectional Clamp Bearing.

their consequent evils is entirely avoided.

The cylinder is made from the best grade of tool steel, which has a more even temper than the cheaper grades of steel, and from which a head of smaller cross section may be used without dan

ger of springing out of true. This gives the advantage of small cutting circle which is essential to fine planing. The journals are forged from the same piece as the cylinder, are 2¼ inches in diameter and run in long, self-oiling bearings. A noteworthy excellence here is the new patent sectional clamp bearings for the cylinder journals. Each of the cap bearings is made up in two sets of thin babbitt metal plates, five to each set. The edges of these plates, in contact with the journals, are turned on the lathe to describe the circumference of the lower bearings. They rest diagonally upon the upper surface of the journals, and exert no pressure downward except that produced by their own weight. Any looseness of the journals from wear may be taken up each day, if desired, by simply loosening the clamp bolts and pressing the plates down with the hand. No packing or liners are used, and the oil chambers being closed by a cover, no dust or grit can get into the bearings. This machine is manufactured by J. A. Fay & Egan Co., Cincinnati, Ohio.

Companies Incorporated

The charter of the St. Thomas Gas Company has been surrendered.

The charter of the Ham & Nott Mfg. Co., Brantford, has been surrendered.

The Superior Portland Cement Company, head office to be changed from Toronto to Orangeville.

The Pembroke Electric Light Co. have secured power to increase their capitalization from $50,000 to $150,000.

Dunlop Tire Co. have changed the corporate name of their company to the Dunlop Tire & Rubber Goods Co., Limited.

The Forbes Hardware Company has been incorporated in British Columbia, the capitalization to be $40,000 and the headquarters at Vancouver.

Standard Bolt & Screw Co., Toronto, share capital $40,000, purpose to carry on machinery business in all its branches. Thomas Clark, Buffalo, Percival Stafford McKergow and John Jennings, Toronto.

Economy Powder Co., Ottawa, share capital $10,000; purpose, to manufacture explosives. The directors are Frank Joy Boyer, John Tyson Embree, Arthur Heim, all of Reading, Pa., and Philip Leslie Neame, of Ottawa.

W. C. Wilcox, Limited, Winnipeg, share capital $200,000; purpose, to manufacture all kinds of tools and machinery. The incorporators are Wm. H. Meneray, W. C. Wilcox, Henry Veasey, Thomas Sharpe and Geo. A. Metcalfe.

The Dominion Engineering & Construction Co., share capital $100,000. The directors are Messrs. E. Mitchell, Edward Fabre Surveyor, Charles Mackay Cotton, Joseph William Weldon and Stephen John LeHuray, all of Montreal.

The Fox Bearings Co., Toronto, share capital $40,000, purpose to manufacture, operate, introduce and sell a certain Canadian patent of invention of Tobias Fox. Directors, Tobias Fox of Woodbridge, and Thomas Sullivan and John Nicol of Pine Grove.

Alexandra Oil & Development Co., Toronto, share capital $100,000; purpose, to carry on mining, milling, reduction and development work. The directors are Arthur Radcliffe Boswell, Herbert Wedderlie Edgar, and Alice Maude McGlasham, all of Toronto.

The Electric Meter and Stamping Company, Toronto, share capital $200,000, purpose to manufacture, sell and deal in all electrical supplies, etc. The directors are Anthony Krane, William Bullock, John Creighton, Fairlie Sinclair and George Kerwin, all of Toronto.

The Brakehurst Oil Company, Sarnia, share capital $100.000, purpose to carry on the operations of a mining, milling, reduction and development company. The directors are George Montgomery Trefts, Buffalo, N.Y., Josephine Winfield Brake, and John Hingston Cooper, both of Sarnia.

Alberta Portland Cement Co., Toronto, share capital $1,000,000; purpose, to manufacture portland cement, lime, clay, plaster, etc. Incorporators are Elias Talbot Malone, J. Worth Mitchell, Anthony L'Estrange, Albert Mearns, and John Alexander Fraser, all of Toronto.

Colonial Cordage Co., Toronto, share capital $50,000; purpose, to manufacture rope, cordage, twines, and all other products of hemp, jute, etc. Incorporators are William Bernard Converse, Stephen L. LeHuray, Joseph William Weldon, and Claude O. Pangman, all of Montreal.

The Canadian Oil & Waste Saving Machine Co., share capital $50,000, Brockville, purpose to buy and sell machines for separating and reclaiming oil waste and other substances. The directors are Francis Edwin Clayes, William Senkler Buell and James Henry Botsford, all of Brockville.

White Silver Co., Toronto, share capital $100,000; purpose, to carry on mining, milling, and reduction and development work. The directors are William Fullerton White, New York; Edward Carlton Hargrave, Bay City, Mich.; William Halloway Wallbridge and John Shilton, Toronto.

The Federal Electric Construction Co., Brantford, share capital $40,000, purpose to carry on the business of manufacturers and dealers in electric motors, dynamos and other electrical machinery. The directors are John Ellis, township of York, George Henry Kilmer and William Henry Irving, Toronto.

The Peterborough Sandstone Brick Company, share capital $50,000, purpose to manufacture, sell, trade and deal in bricks and other building material made of sand. The directors are John Joseph English, Hastings, Andrew Brown, John James Hartley and Ernest Simpson, all of Peterborough.

Baynes Carriage Co., Hamilton, share capital $250,000; purpose, to carry on the business of wholesale carriage and vehicle manufacturers and dealers. The directors are Charles Tooker Grantham, Henry Norman Kittson, Peter Duncan Crerar, William Southam, Frederick William Gates, Paul Augusta Kompass. and James Bibby Baynes, all of Hamilton.

The Niagara Engine Works, Niagara-on-the-Lake, share capital $50,000, purpose to manufacture and sell gas and gasoline engines and other classes of engines and machinery. The directors are Egerton Ryerson Lundy, Haggai Gustavus Adolphus Cook, Francis Gustavus Kick, Hamilton Merritt Robinson, and James Albert Keyes, all of Niagara Falls, Ont.

The Sublime Hygienic Cement Flooring Co., Toronto, share capital $50,000, purpose to manufacture hygienic cement tiles and blocks and marble mosaic, and to carry on a general building, construction and paving business. The directors are Leopoldo Ponzeo Scarrone, Louis Vincent McBrady, Luigi Del Negro, Pietro Venier, Umberto Corsi and Joseph Murphy, all of Toronto.

Ruethel Mining Company, Windsor, share capital $250,000, purpose to carry on in all their branches the operation of a mining, milling, reduction and development company. The directors are William Augustus Thorpe, Henry Clay Rees, William Wilmon Newcombe, Charles Mallory Hovey, Archibald McPhail, John William Wolst Baker, and George Joslin Munsell, all of Detroit, Mich.

Canada Steel Goods Co., Hamilton, share capital $115,000, purpose to buy, sell and deal in manufactured metals, etc. Directors are John Straith Ainslie and Ralph Oliphant Young Ainslie of Comber, Arthur Frederick Hatch of Toronto, Arthur Ludlam, Arthur George Moffat and James Dryden Ainslie of Leamington, James Sim Wardlaw, Charles Cumming and George Hancock of Galt.

The Automobile Import Co., Montreal, share capital $20,000, purpose to manufacture, buy, lease and deal in all kinds of vehicles, pleasure boats, whether propelled by electricity, steam, naptha, gasoline or otherwise. Incorporators are Arthur Ellegood Hayes Crawford, Frederick Rubidge Crombie, Waldo Whittier Skinner, Ronald Cameron Grant and George Gordon Hyde, all of Montreal.

Municipal Trenching Co., Montreal, share capital $1,000,000, to undertake the work of excavating, trenching and dredging, removing rock and other material, and to manufacture. operate and sell all kinds of machinery connected therewith. The incorporators are Frederick Carleton Austin, Chicago, Ill.; Joseph William Harris, Harold A. Richardson, Frederick Henry Markey and Ronald Cameron Grant, all of Montreal.

INDUSTRIAL PROGRESS

Machinery and Manufacturing News would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

THE Canadian Pacific Railway Company are planning to establish an elevator with a capacity of 1,000,000 bushels at Vancouver. They are also looking into the possibility of operating trains through the mountains by electric energy, for which work 65,000 h.p. is now under development from a waterfall in the vicinity of Calgary.

A match factory is to be established at Kenora.

The Doherty Stove Works at Sarnia have been enlarged.

The Whyte Packing Co.'s factory at Mitchell is being enlarged.

The Jackson Wagon Works of St. George may remove to Galt.

Senator Choquette is to erect a building in Quebec to cost $11,000.

The Dominion Oilcloth Co. are to build a $10,000 factory at Montreal.

Jas. Clinkskill has had plans prepared for a new cement block at Saskatoon.

The Standard Wire Fence Co. are to erect a new factory in Woodstock, Ont.

The Minerva Mfg. Co. are to erect a large factory on College street, Toronto.

J. Y. Griffin & Co. are building an addition to their factory at Elmwood, Man.

The Sawyer-Massey Co., Hamilton, are to build a new foundry, to cost $20,000.

The Northwest Machinery & Iron Co., Winnipeg, have assigned to John W. Lord.

The big plant of the Canada Car Co., at Montreal, has commenced operations.

The London Box Co. are to rebuild their factory which was recently burned down.

The Winnipeg Rubber Co. have decided to erect a large warehouse in Calgary.

The Marine City Sugar Co. may remove their factory from Michigan to Canada.

Colonel H. M. Pellatt is to erect a $200,000 residence and a $40,000 stable in Toronto.

The Imperial Oil Works, Sarnia, is making improvements to its plant to cost $35,000.

Welsh coal exporters are hoping to establish a trade with Canada in anthracite coal.

The new plant of the Dominion Iron & Steel Co. in Newfoundland has been completed.

Work on the Canadian Metal Company's smelter at Frank, Alta, is progressing favorably.

The Clevcland-Sarnia Saw Mills Company contemplate establishing a match factory at London.

The American Window Glass Machine Co. expect to employ 400 hands in their new factory at Cayuga.

The C.P.R. are erecting a large machine shop, forty by forty-eight feet and two stories, at Havelock.

The Canadian Rand Drill Co. are contemplating a large addition to their plant at Sherbrooke, Que.

The Dominion Atlantic Railway are now operating the Midland Railway in connection with their system.

The Standard Bank are to spend $20,000 on alterations to their building on Wellington street, Toronto.

The Merchants' Rubber Co., Berlin, are to build another large factory in order to increase their output.

Work has been commenced on the new thread factory being erected in Stratford by Dr. Beattie Nesbitt.

Thomas McGill, Kearney, Ont., proposes to organize a $40,000 company and manufacture chairs at Cornwall.

Briquetted coke, the new fuel, is now being retailed in Montreal by the Light, Heat & Power Co. at $5.50 per ton.

The Improved Match Co. are to begin operations at once at Drummondville, Que., seventy-five men being employed.

The Toronto Railway Co. have purchased 2,000 tons of 90-pound rails from the Lorraine Steel Co. of Pennsylvania.

The peat works at Fort Frances are now in full operation. A large amount of electrical machinery has been installed.

A cedar mill with a capacity of 40,000 feet of lumber a day is being erected at Greenway Sound, B.C., by J. S. Emerson.

A $10,000 school is to be erected at Rosebank, Man., and a new Church of England is to be erected at the same place.

J. W. Doherty has sold the Norwich Brush & Broom Factory to a new company, who intend opening warerooms in Toronto.

The American LaFrance Fire Engine Co., Elmira, N.Y., are considering the advisability of opening a new factory in Winnipeg.

Pisch Bros., of Lacrosse, Wis., are are likely to establish a factory in London for the manufacture of a patent cigar box.

The Dominion Government is calling for tenders for the construction of the Indian and Fisheries Building at New Westminster.

The Durant-Dort Carriage Co. of Flint, Michigan, and Sarnia, is to enlarge its establishment in the last named place.

The liabilities of the Canada Launch & Engine Works, recently placed in liquidation, are $17,400, and the assets nominally $28,739.

The Baynes Carriage Co. are locating a new factory in Hamilton, bringing the plant for their new works from their Buffalo factory.

The Red Cedar Lumber Company's mills near Vancouver, recently destroyed by fire, are to be rebuilt and new machinery installed.

H. Lamontagne & Co., wholesale harness manufacturers, Montreal, have decided to establish a distributing warehouse at Brandon.

Windsor may be the manufacturing headquarters of the Canadian Fencing Co., a Michigan concern which makes a new style of wire fence.

It was stated that at least 8,000 people in Hamilton are unable to rent homes. The Westinghouse Co. has decided to erect 300 new houses.

Maritime Engineering Co., Moncton, have been installing machinery in the new saw mill erected by the A. L. Wright Co., at Salisbury, N.B.

Work has commenced on getting the Simpson mill at St. Catharines ready for the machinery for engine works which are to be established there.

A new hotel to cost $300,000 is to be erected on Ward's Island, Toronto. The promoters are Judge Morgan, Thomas Aikenhead, Major Carlaw and others.

Buildings to the total value of $613,000 were authorized in Vancouver during September, this including a permit for the new post office, to cost $500,000.

The annual statement of Granby Consolidated shows a surplus of $712,649 for the year 1905. The amount expended for improvements was over $485,000.

A $20,000 concrete and steel bridge is to be constructed across Rideau River near Herdsmen's Bridge. The work is to be done by the Montreal Bridge Co.

A site has been purchased on Van Horn street, Toronto, by W. H. Hutchinson, and it is understood that a factory for a new industry is to be erected.

Coal operators in British Columbia are urging the Tariff Commission to impose a duty on petroleum, which is largely used for fuel on the Pacific coast.

The Hamilton Bridge Company have received contracts from the Provincial Department of Works for two bridges over the Mattawa River, the cost to be $8,900.

The Hampel Paper Box Co., of Brantford, are adding new machinery to their plant and extensive alterations and improvements are contemplated in the near future.

The contract for the construction of the Lake Superior branch of the Grand Trunk Pacific Railway has been awarded to Foley Bros., Larsen & Co., of Winnipeg.

The reported sale of the New Brunswick Petroleum Co. to English parties is denied. The company is seeking to increase its capital in order to develop its oil areas.

The Bains Carriage Works, Buffalo, are to be moved to Hamilton. The company will build a factory with the capacity of 100 buggies a day, four hundred men being employed.

T. J. Drummond, vice-president of the Lake Superior Corporation, says that the output of ore at the "Big Helen" mine near the "Soo" will be over 200,000 tons this year.

The Dominion Coal Co. intend erecting several large new buildings at Glace Bay, N.S. The work will include a warehouse, machine shop, foundry, and probably a car shop.

The Brantford Felt & Rubber Co. have purchased the factory lately occupied by the Bailey Cutlery Co., and will install the necessary machinery for manufacturing felt and rubber footwear.

Building permits have been issued in Hamilton to the following: H. G. McMahon, three dwellings, $6,000; Noble & Co., four dwellings, $3,400; W. A. Stephens, two dwellings, $3,500.

The contract for the steel structural work in connection with the extension of the Canada Paint Company's Montreal plant has been awarded to the Dominion Bridge Co. of Lachine.

The first consignment of steel rails for the new Toronto-Sudbury division of the C.P.R. have been received at Owen Sound from the Lake Superior Consolidated Co.'s mills at the Soo.

Fort Frances is to have another saw mill in the near future. It is intended to manufacture barrel staves and heads out of poplar, of which there is abundance in the immediate district.

The Pilot Bay smelter situated on Kootenay Lake, near Nelson, B.C., has resumed work after being closed since 1898. The zinc reduction works will be used in conjunction with the plant.

The Mutual Binder Twine factory at Brandon, Man., has been sold for $15,700. The plant originally cost $65,000, and the new owners will continue to use it in making binder twine.

Ross & MacRae, Strathroy, have secured a contract for the construction of twenty-five miles of railway between Three Rivers and Shawinigan, the contract amounting to about $500,000.

A company has been formed to establish a large power generating plant on the Thames River about eight miles from London, Ont. J. M. McEvoy is one of the promoters of the company.

Port Arthur has voted to expend $112,000 to improve its water system, $110,000 for a sewerage system, $10,000 for a new fire hall, and $18,000 to extend the municipal telephone system.

The Canadian Electrical Development Co. have entered into an agreement with the Toronto, Hamilton Railway Co., whereby the latter firm will construct a line between Toronto and Niagara Falls.

A Moncton man named Joseph Stratton has invented a new babbitt metal which is attracting considerable attention and a large industry to manufacture the metal may he established at Moncton.

The Brandon Machine Works Co. has received the contract for all the iron work which will be required in the construction of the new $42,000 school building now being erected at Moosejaw.

The Dominion Iron & Steel Co. are considering improvements for enlarging the output of the open hearth steel department—that is, the supplementing of modern machinery to improve the tonnage.

The operation of the street railway, electric light and gas franchises at Cornwall has been taken over by the Sun Life. A new office is being built for them in Cornwall by J. B. Atchison & Co.

The Chimalapa Land Co. have decided to build large mills at Montreal, the mills to be equipped with the latest machinery for the manufacture of lumber from the company's property in Mexico.

The Rideau Mfg. Co., Ottawa, are erecting a large factory, in which they will employ four hundred to five hundred hands in making ladies' clothing. The company have a branch office in Winnipeg.

It is proposed to establish a veneer mill at St. John. N.B., for handling the woods grown on the property of the Chemalpa Land Co. of Mexico. G. W. Fowler, M.P., is the president of the company.

Work on the construction of the iron ore smelter at Port Arthur is progressing very favorably and it is expected that it will be in operation this winter. The blast furnace will employ a large staff of men.

The Westinghouse interests have purchased a site on the Niagara frontier on which they will build a large plant for manufacturing electrical machinery. The site selected is on the Niagara Gorge below the Falls.

Toronto (No. 1) branch of the Canadian Association of Stationary Engineers held its nineteenth annual banquet at the Walker House on Thanksgiving 'eve, October 25th, which was highly successful.

The report of the directors of the Dominion Iron & Steel Co., who hold their annual meeting on October 18th, shows that the earnings for five months amount to $366,062, not including the profits on the steel rail mill.

Port Hope has completed arrangements with a new company who will establish a factory in that town to manufacture building paper, etc. Fifty men will be employed and $50,000 will be spent in machinery and building.

Rhodes, Curry & Co., of Amherst, N. S., have received a contract from the I.C.R. for the building of two hundred box cars, one hundred to be built with a capacity of 30 tons and one hundred with a capacity of 40 tons.

Two new Campbell gas engines are being installed by Wayland, Williams & Dadson, Montreal. One of 50 horse-power is being put into a plant in the city while the other, of 35 horse-power, is being set up just outside Montreal.

The Jenckes Machine Co., of Sherbrooke, Que., have placed an order with the Pedlar People, of Oshawa, for nearly eight hundred squares of corrugated galvanized roofing, to be used in covering their new plant at St. Catharines, Ont.

The Haskill Lumber Co. are making great progress in Fassette, Que. They have recently purchased a new locomotive for the Salmon River & Northern Railway, for hauling out the timber, which will be transported by rail rather than by water.

The Nova Scotia Steel & Coal Co. for the nine months ending September 30th shipped 398,095 tons from their mines, as against 350,846 tons for the corresponding period last year. During September the company shipped 12,332 tons profits.

The British Columbia Electric Railway Company has just distributed $17,000 to the men in its employ in the shape of a co-operative dividend. Every man in the service gets $40. Last year's dividend to the employes netted each man $35, and the previous one $25.

The Ontario Electric Power Co. at Niagara Falls has completed a contract with an American firm to deliver 30,000 horse power at $12 per horse power, and have closed another contract in Welland for 1,200 horse power for $15 per horse power.

The Electrical Supply Co. of Moncton has been organized with John S. McGee as president. The company has taken over a patent adjustable electric lamp, patented by Osten Berry of Ottawa, and will also carry on an electrical supply business.

The Wolverine Cedar Lumber Company of Menominee, Que., have closed a deal for a large tract of timber on the Spanish River, Ontario, estimated to contain more than 100,000,000 feet. The price paid was $5 per thousand, or $500,000 for the entire tract.

The Canadian Pacific Railway have commenced the erection of five new buildings near the Angus shops, Montreal, the total cost of which will be $33,550. The new structures will include two restaurants, a paint shop, a storehouse for old material.

The Grand Trunk Railway have offered a free site and $4,500 for the erection of a Y.M.C.A. building at Allandale if the townspeople will contribute an equal amount with the railway for the maintenance of the building. Work will likely be commenced this month.

Ker & Goodwin, Brantford, Ont., who have moved into their new machine shop, are completing arrangements for the manufacture of all sizes of chucks up to 24 inch. They expect to be prepared to meet any demands of the Canadian trade within a few weeks.

A company has been organized at Fort William, to be known as the Northern Engineering Construction, Heating & Supply Co., capitalized at $100,000, and a large foundry will be constructed. W. J. Ross and John Crearer are interested in the company.

A 7,000-ton steamer is now being constructed in England for the ore-carrying trade of the Dominion Iron & Steel Co. She is being built by Wilhelm Wilhelmson, of Tonsberg, Norway, and is expected to arrive in Sydney at the opening of navigation, next Spring.

Work on the building of the extension of the Niagara, St. Catharines & Toronto Railway from Falls View to Montrose has been commenced. This extension will form the connecting link between the N., S. & T. system and the projected Toronto & Hamilton Railway.

The Chatham, Wallaceburg and Lake Erie Electric Railroad paid duty on machinery and equipment last week amounting to $25,600. Already some

$75,000 have been spent on the building and machinery in the power house at Chatham. The line is now complete between Chatham and Wallaceburg.

The John Gooderson Threshing Co., who recently purchased the works of the Canadian Machinery Co. at Point Edward, destroyed by fire a month or so ago, are making extensive improvements to their plant. the new additions including a wood-working room, a paint shop, etc.

The first Wabana, Newfoundland, ore received on the northeast coast of England was recently unloaded at Connal's wharf, Middleborough, for the North-eastern Steel Co., Limited. The cargo amounted to 4,500 tons and was obtained from mines owned by the Nova Scotia Steel & Coal Co. and the Dominion Iron & Steel Co.

On the morning of October 6th the Atlantic Cable Co.'s new Atlantic cable was completed, the bad weather having delayed the completion for some days. The signalling saved is 15 per cent. greater than other Atlantic cables. The cost varied from $1,000 to $6,000 per mile according to the depth of the water and the character of the ocean bed.

By a vote of 236 for and 93 against, the Nanaimo coal miners have decided to return to work. The agreement between the company and the men is in the nature of a compromise, each side conceding something. It is for a period of two years, which means that for that period of time Nanaimo will be free from the evil results of strife between capital and labor.

Peter Lyall & Sons, Montreal, have sublet the contract for laying the floors of the new steel sheds which they are erecting on the wharves. Messrs. Stack & Brogan were the successful tenderers, and they estimate that it will take about 200,000 scoria blocks to complete the ground floor of No. 2 shed, some four hundred yards of which have already been finished.

Whalen & Bowman, of the Great Lakes Dredging Co., of Port Arthur, have purchased a site on island No. 2 at Fort William for the building of a dry dock and marine railway, together with a foundry and machine shop. The town is granting exemption from taxes for ten years and will also close the street in front of the site. The new industry will employ about one hundred men.

The British Columbia Electric Railway Co. is having machinery installed in its Store street quarters as quickly as possible. The building when completed will act as an auxiliary to their Gold Stream power. If the electric power on the latter at any time becomes insufficient for the operation of the street railway cars and lighting systems the former plant will be called into service.

In the list of manufacturers of gasoline engines published in last month's issue of Canadian Machinery, the name of the Toronto Gas & Gasoline Engine Co. was inadvertently omitted. This firm have recently moved from Toronto Junction into a larger factory on Dufferin street, Toronto, and intend manufacturing an even more extensive line of gas and gasoline engines than has been the case in the past.

The Dominion Coal Co. has been considering some improvements at the works. A $100,000 contract has been awarded to the Canadian Westinghouse Co. for installation of electrical apparatus for the collieries at Glace Bay, N.S. The contract calls for three generators of 500 k.w. each, twelve motors, and 89 transformers. The motors will be used for driving pumps and other machinery about the mines.

The Canadian Fairbanks Co., Montreal, have just closed a contract for all transmission material used in the new plant of the Boston Last Co. at Richmond, Que. This order includes Fairbanks Universal Giant Hangers, Oneida Steel Split Pulleys, Universal Giant Friction Clutches, shafting, couplings, etc. A similar order has also been received from the Dominion Coal Co. for the installation of transmission material in their plant at Sydney, C.B.

The Cartierville Electric Light & Power Company are building a steam plant at Cartierville, Que., for the purpose of furnishing electric light and power to the town of St. Laurent at Montreal. The company has secured contracts for the street lighting and also for pumping the water to the St. Laurent waterworks. Mr. Charles Brandeis, civil engineer, of Montreal, has been retained as consulting engineer to design and to supervise the installation.

Building has been very active at Peterborough during the present year and it is estimated that the total outlay for the year will reach $400,000. About 200 new houses will be erected, an increase of about 50 over last year. Amongst the large enterprises under way are the following: New Opera House, $30,000; American Cereal Co., mill and elevator, $45,000; Peterborough Shovel & Tool Co., factory, $15,000; Separate School, $25,000; Methodist Sunday School, $5,000.

A proposition has been made to Sarnia by Messrs. Richards & Maguire of Cleveland, offering to establish a machinery plant in Sarnia to continue the business of the Canada Machinery Company, which was recently burned out at Point Edward. The offer is to build a plant and maintain a force of 125 to 200 men, with a payroll of $80,000 annually, on condition that the town will supply a site and extend a loan of $25,000 for a period of five years for building purposes.

Another industry is reported to have been secured by Hamilton, namely the Bains Carriage Co. of Buffalo, which has decided to establish a branch factory in Canada. The company will be a thoroughly Canadian one here as far as charter and incorporation is concerned, and will number among its stockholders a number of wealthy men of Hamilton. Patents have already been secured for available factory site, and as soon as a decision can be made work on the new factory will be commenced.

The furnace plant of the Atikokan Iron Company is in course of construction on Thunder Bay, about midway between Port Arthur and Fort William. The furnace can scarcely be ready before late next year. Coke ovens of the bee hive type will be built, but no steps have yet been taken toward construction. To facilitate the smelting of the magnetic sulphuric ores of the Atikokan a large crushing plant and roasting beds will be established at the furnace, waste gases of the stack heing expected to do what roasting is needed

In Winnipeg the building record is greater than ever. Compared with the total figures for previous years it shows a marvelous increase. In last year's record several millions were represented by the new C.P.R. terminals, the Eaton block, the gas works improvements and other large structures. There are over 1,200 more buildings this year to date than last year, but the majority of these are residences. The report is as follows: 1904—Permits, 1,768; buildings, 2,268; cost, $9,651,750. To Sept. 30, 1905 — Permits, 2,761; buildings, 3,539; cost, $9,627,950.

The Pratt & Whitney Co., of Hartford, Conn., have purchased a plant in Dundas, Ont., for the manufacture of its full line of small tools, taps, reamers, milling cutters, punches, dyes, etc. The building is a modern structure and the power plant is already in place. The machinery equipment is being gotten ready and will be sent there and operations begun immediately. This plant will also include a department for manufacturing a full line of twist drills and elaborate equipments of special machinery having been purchased for this purpose. The output of this new factory will be handled by the Canadian Fairbanks Co., Limited, who will have the exclusive sales agency for Canada.

Bounties were paid on iron and steel from 1898 up to June 30 last amounting to $5,702,967. For the last fiscal year the amount was $1,540,041, against $908,962 for the previous twelve months. The Dominion Iron & Steel Company received $676,880, which was the largest amount paid to any corporation. The Algoma Steel Company, Limited, came next, with $401,956. The following were the bounties paid out last year for these products: Pig iron, $62,666; puddled bars, $7,894; steel ingots, $614,433; manufactures of steel, $293,208; lead, $233,844; lead exported for treatment, $96,800; binder twine, $13,789; crude petroleum, $350,047; total, $2,234,685. The amount paid for crude petroleum, at 1½ cents per gallon, would represent a total production of 52,507,050 gallons.

Henry Disston & Son, saw manufacturers, of Philadelphia, have commenced work on the erection of their new brick and steel two-storey factory, at 112 Adelaide street east, Toronto. The new building will be modern and fireproof in every respect, and will be equipped with the latest machinery for the manufacture of circular and band saws, and mill goods. The new factory will be in operation before January 1st, and seventy-five men will be employed to commence with. Goods for the export trade and Canadian market will be manufactured. The Canadian branch of the Disston Co. is incorporated under an Ontario charter, the capitalization being $100,000. The charter was secured before the anti-dumping clause came into effect, so that this tariff legislation was not the means of bringing the Disstons to Canada. Mr. W. E. Radcliffe will have the management of the Canadian branch.

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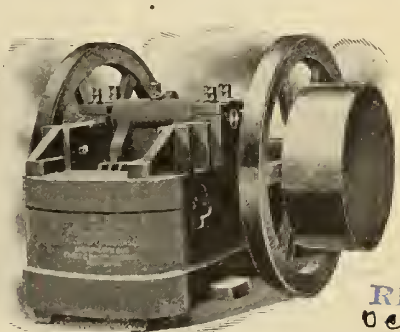

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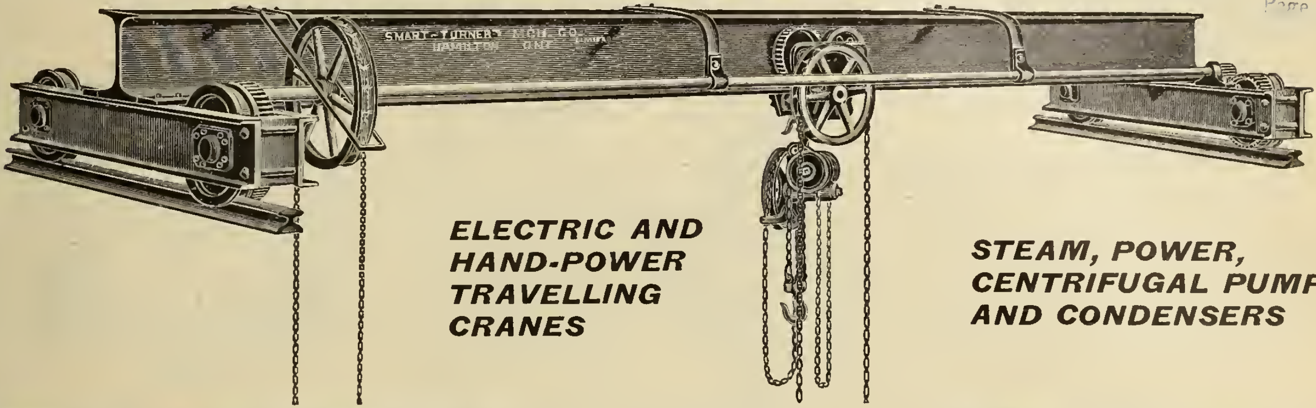

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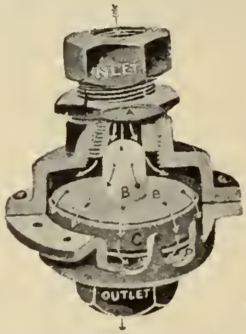

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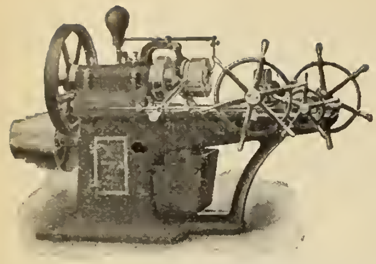

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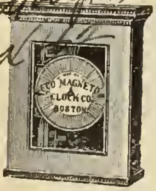

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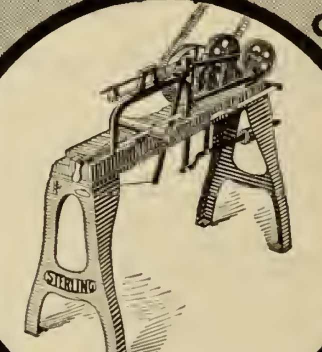

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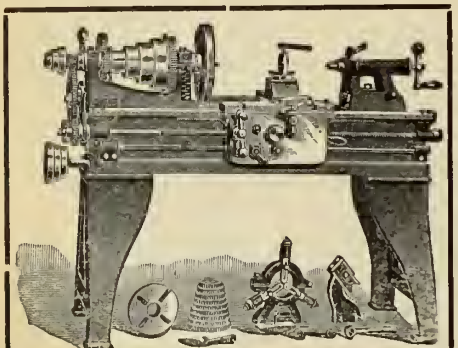

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Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Dies, Opening.
W. H. Banfield & Sons, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.
W. H. Banfield & Sons, Toronto.
The Globe Machine and Stamping Co. Cleveland, Ohio.

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W. H. Banfield & Sons, Toronto.
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B. F. Sturtevant Co., Hyde Park, Man.

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Canadian Drawn Steel Co., Hamilton.
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Dredges, Gold, Dipper and Hydraulic.
Allis-Chalmers-Bullock Co., Montreal.

Drilling Machines, Arch Bar
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.

Drilling Machines, Boiler.
American Tool Works Co., Cincinnati.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
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Drilling Machines, Connecting Rod.
John Bertram & Sons Co., Dundas, Ont
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Drilling Machines, Locomotive Frame.
John Bertram & Sons Co., Dundas, Ont
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Drilling Machines, Multiple Spindle.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
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Bickford Drill & Tool Co., Cincinnati.
Canada Machinery Agency, Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

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Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drilling Machines, Portable.
A. B. Jardine & Co., Hespeler, Ont.

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American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Bickford Tool & Drill Co., Cincinnati.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
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John Bertram & Sons Co., Dundas, Ont.
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Drilling Machines, Turrett
Niles-Bement-Pond Co., New York.

Drilling Machines, Upright.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co. Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Krug & Crosby, Hamilton.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
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B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
King & Crosby, Hamilton.
London Machine Tool Co., London.
Pratt & Whitney Co., Hartford, Conn.
Francis Reed Co., Worcester, Mass.

Drills, Blacksmith.
Francis Reed Co.. Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Centre.
Pratt & Whitney Co., Hartford, Conn
L. S. Starrett Co., Athol, mass.

Drills, Clamp.
Francis Reed Co., Worcester, Mass.

Drills Electric.
Chicago Pneumatic Tool Co., Chicago.

Drills, High Speed.
Wm. Abbott, Montreal.
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Drills, Horizontal.
B. F. Barnes Co., Rockford, Ill.
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Canada Machinery Agency, Montreal.
London Machine Tool Co., London.

Drills, Pneumatic.
Chicago Pneumatic Tool Co, Chicago.

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Drills, Ratchet.
A. B. Jardine & Co., Hespeler.
Mechanics' Supply Co., Quebec.
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Armstrong Bros. Tool Co, Chicago.

Drills, Rock.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.
Francis Reed Co., Worcester, Mass.
Krug & Crosby, Hamilton.

Drills, Shop View.
John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.
Chicago Pneumatic Tool Co., Chicago.
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Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

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Chicago Pneumatic Tool Co., Chicago.

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Chicago Pneumatic Tool Co., Chicago.

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Canadian General Electric Co., Toronto.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
The United Electric Co., Toronto.

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Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
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Armstrong Bros. Tool Co., Chicago.
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John Bertram & Sons Co., Dundas, Ont.
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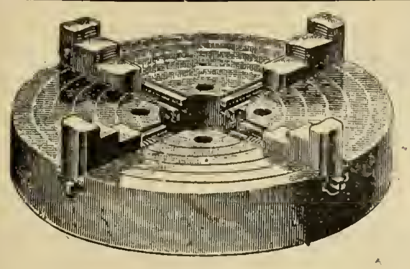

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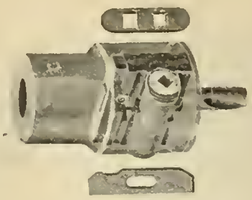

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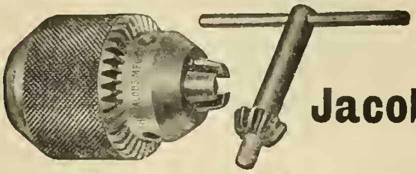

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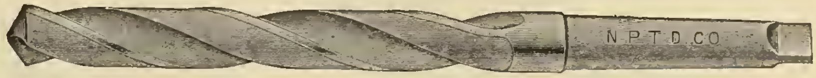

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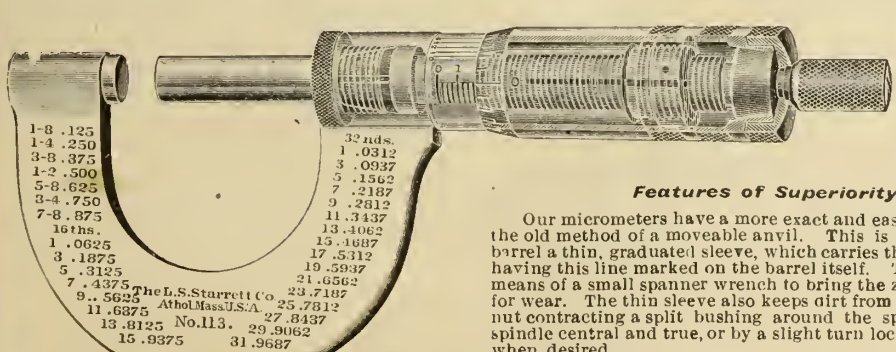

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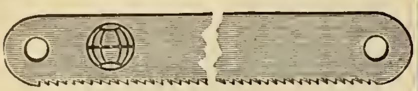

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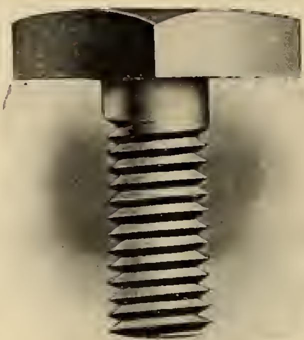

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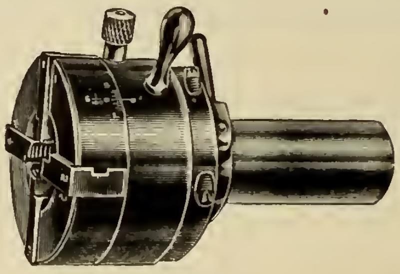

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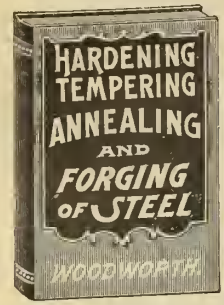

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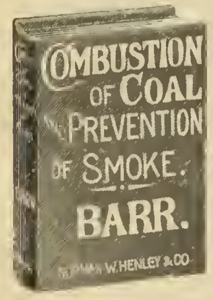

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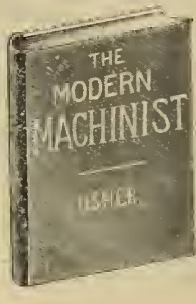

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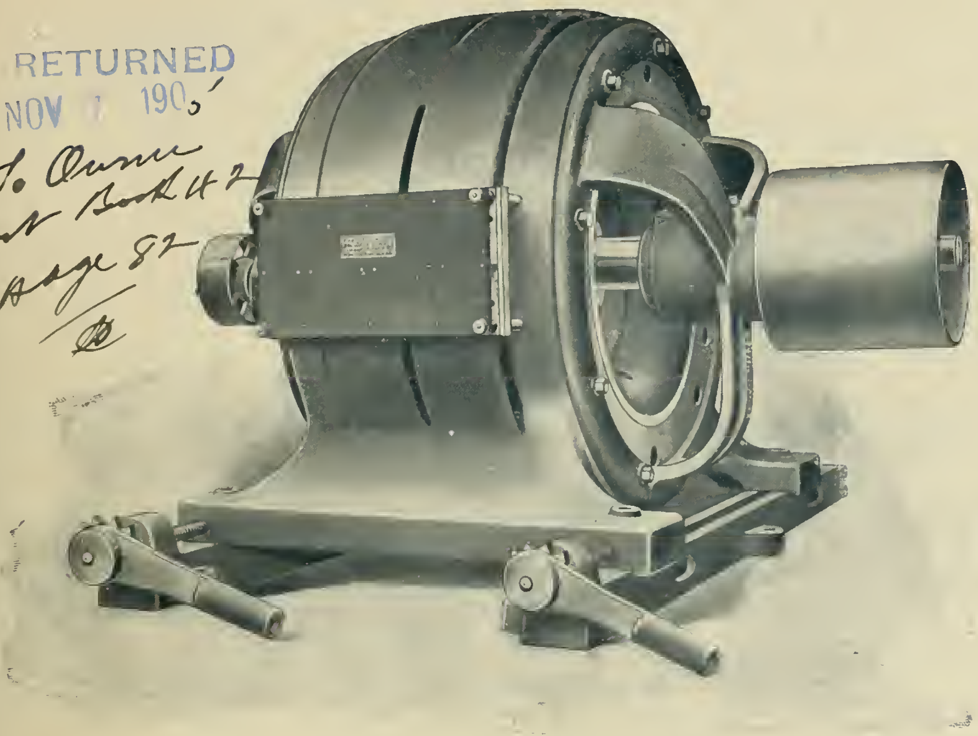

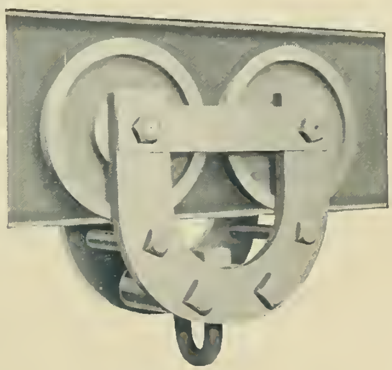

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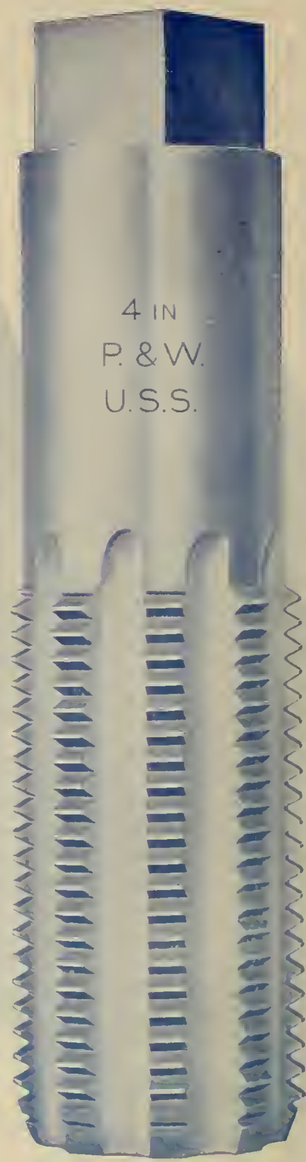

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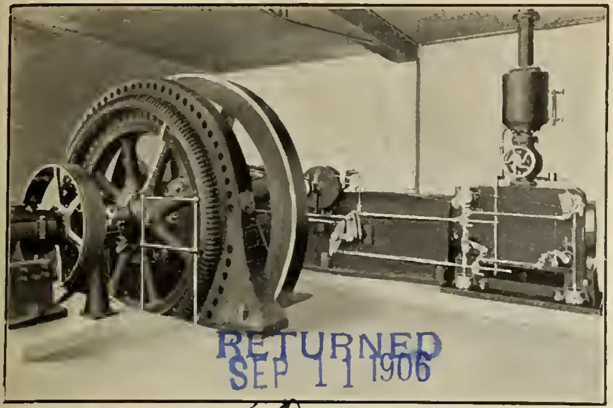

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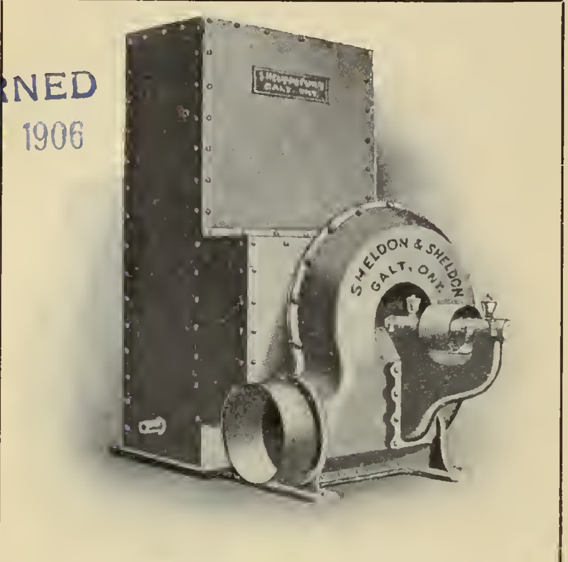

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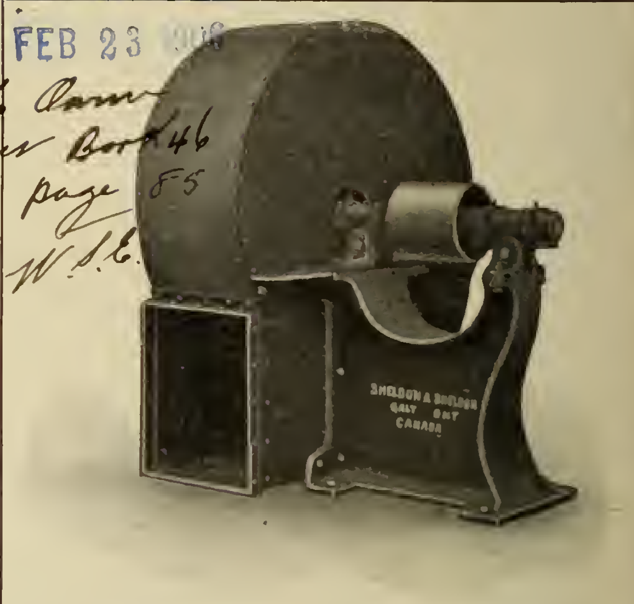

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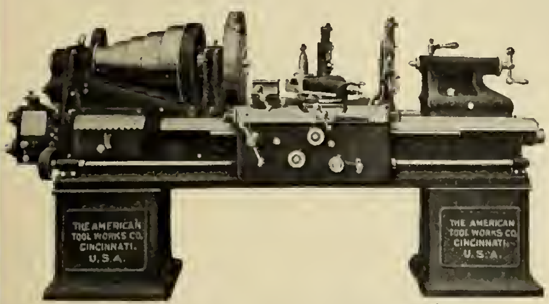

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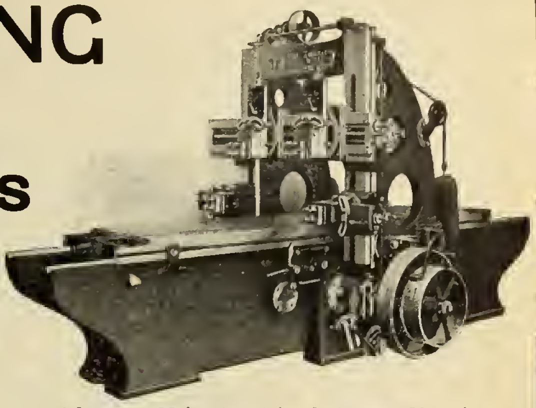
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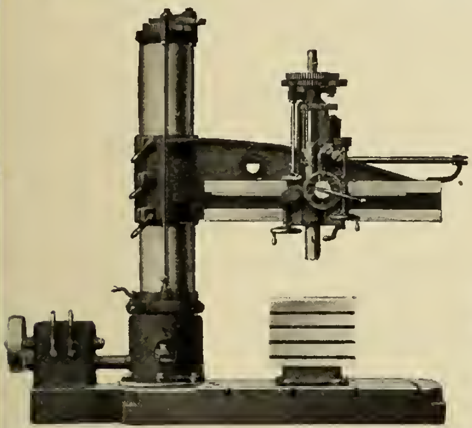
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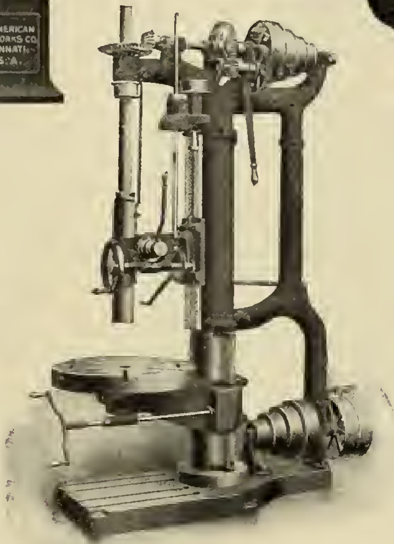
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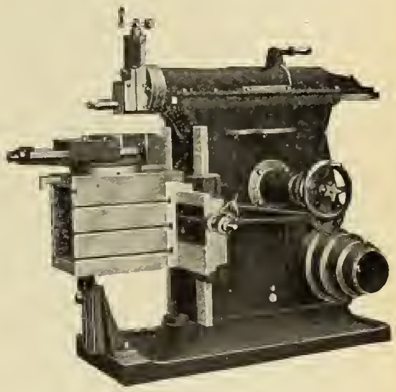
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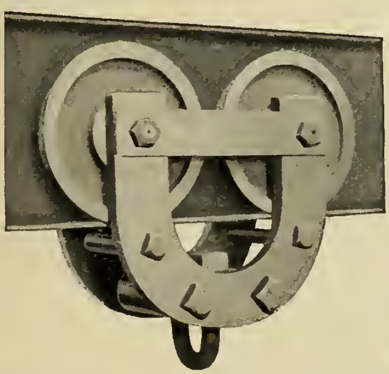

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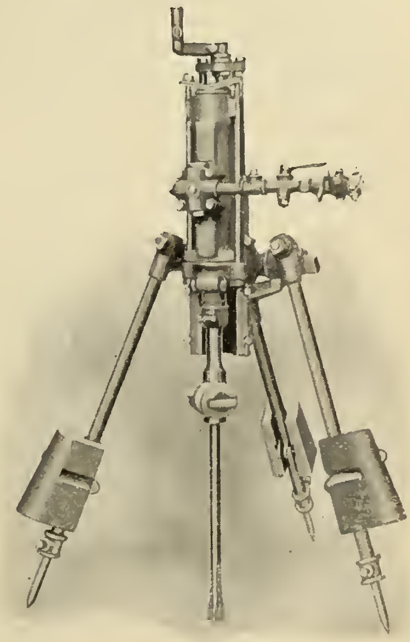

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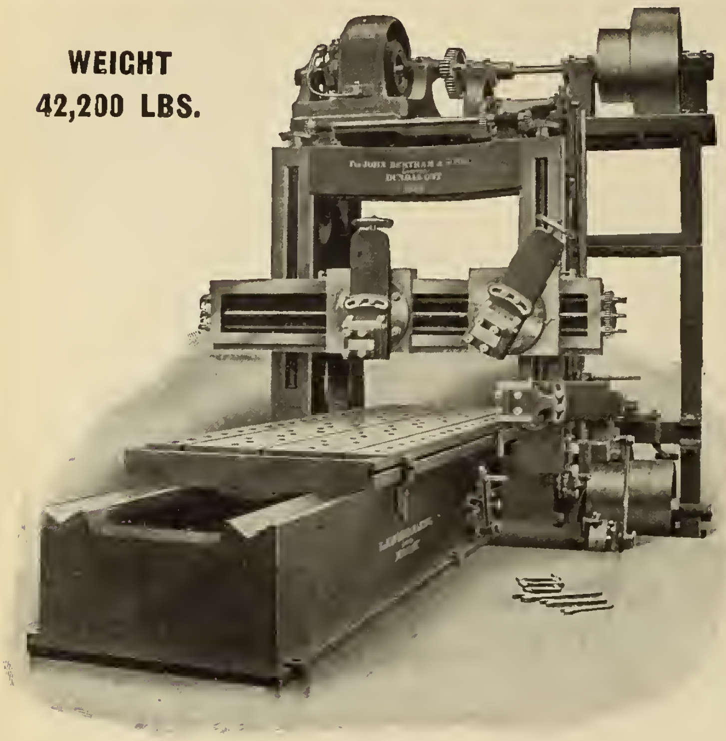

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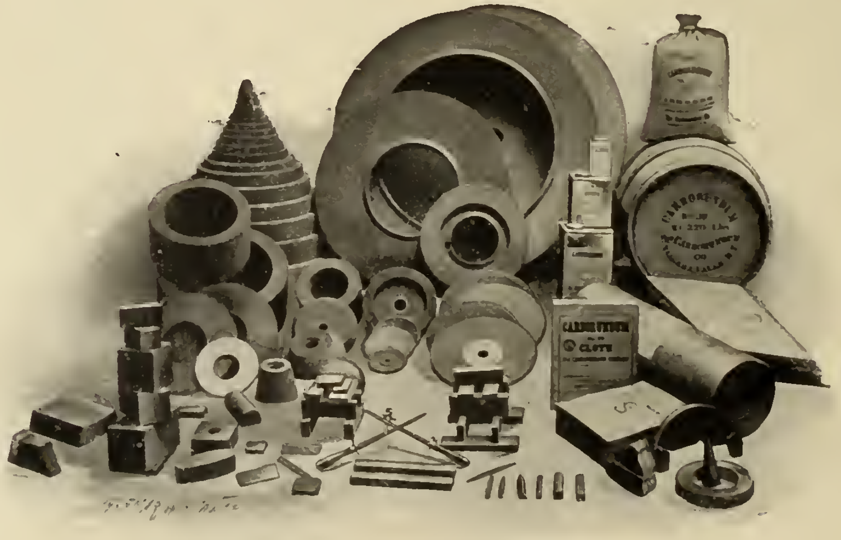

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Offers the following—selected from his present stock of

NEW AND SECOND HAND MACHINERY

Horizontal Boilers

66″ x 14′ almost new.
60″ x 17′ 6″ with 54 4″ tubes.
6″ x 13′ 7″ " 84 3″ "
56″ x 14′ 4″ " 64 3″ "
60″ x 12′ " 82 3″ " NEW.
56″ x 12′ " 62 3″ "
48″ x 16′ " 33 4″ "
48″ x 13′ 6″ " 52 3″ "
48″ x 13′ 6″ " 42 3″ "
44″ x 13′ 6″ " 43 3″ "
44″ x 14′ 6″ " 40 3″ "
44″ x 11′ 9″ " 42 3″ "
40″ x 12′ " 21 3″ "
38″ x 12′ " 36 3″ "
32″ x 11′ " 22 3″ "

Upright Boilers

48″ x 10′ 6″ with 152 2″ tubes.
36″ x 72″ " 60 2″ "
26″ x 60″ " 37 2″ "
20″ x 48″ " 31 2″ "
24″ x 50″ " 31 2″ "
20″ x 40″ " 41 2″ "
20″ x 36″ " 16 2″ " NEW.
19″ x 44″ " 13 2″ " NEW.
19″ x 40″ " 9 2″ " NEW.

Automatic Engines

16″ x 36″ NEW Laurie Corliss.
15″ x 34″ Left hand Wheelock.
13″ x 30″ Right hand Corliss.
13″ x 30″ Left Hand Wheelock.
11″ x 24″ " " Corliss.
10″ x 24″ Right hand Corliss.
12″ x 10″ Westinghouse Junor.
12″ and 20″ x 12″ Erie Ball Tandem compound.
11″ and 19″ x 15″ McIntosh & Seymour Tandem compound.
10″ x 15″ NEW No. 8 Jewel.
8″ x 10″ " 5 "
8″ and 13″ x 18″ Tandem compound.
6½″ x 8″ Armington & Sims.
5″ x 7″ " "

Other Steam Engines

Complete generating plant, consisting of 2 17″ x 38″ Wheelock Engines; 2 73″ x 14′ Goldie & McCulloch Boilers; 2 8″ x 12″ x 12″ Condensers, Pumps, Heaters, etc. Also 2 100 K.W., M.P.—4 Generators, Canadian General Electric Co. make. This plaut was last used to run an Electric Railway line of 10 cars.

12″ x 12″ Laurie, NEW, horizontal.
9″ x 10″ Leonard C.C.
8¾″ x 9″ horizontal.
8″ x 8″ Laurie, NEW, horizontal.
7″ x 12″ borizontal.
7½″ x 9″ Dutton, NEW, horizontal.
7″ x 7″ NEW, uprigbt.
6″ x 9″ horizontal.
6″ x 7½″ " centre crank.
6″ x 8″ uprigbt.
6″ x 6″ " NEW.
5″ x 6″ horizontal.
5″ x 7½″ upright, centre crank.

Also several small engines down to ¾ h.p., horizontal and upright.

Marine Engines

8″ and 16″ x 12″ NEW, fore and aft.
7″ and 14″ x 10″ " " "
7½″ and 14″ x 12″ steeple compound.
9″ x 12″ Doty.
9″ x 12″ NEW, complete.
7½″ x 8″ " Dutton.
6″ x 6″ all complete.
5″ x 7½″ " "

Also several smaller ones.

Miscellaneous Engines and Boilers

48″ x 9″ Upright Sub. Tube Boiler.
30″ x 84″ " " " "
36 H. P. Horizontal Self-Cont. Boiler.
8 H. P. " " " "
25 H. P. Fire Box Boiler.
16 H. P. Waterous Portable Boiler.
7″ x 10″ Cornell " "
74″ x 11″ Clyde Boiler.
48″ x 72″ Fitzgibbon Boiler.
4 H. P. Acme Engine and Boiler.

Gas or Gasoline Engines

One 50 H. P. New Obio.
One 21 H. P. New Ohio.
One 15 H. P. Pierce.
Two 14 H. P. New Ohio.
One 14 H. P. Ohio on wheels.
One 12 H. P. Brantford.
Two 10 H. P. Haggas.
Three 8 H. P. Ohio, NEW.
One 7 H. P. Triton-Marine.
Two 6 H. P. Ohio.
One 6 H. P. Toronto Junction.
One 5 H. P. New Adams Marine.
Four 4 H. P. New Ohio.
One 3½ H. P. Triton-Marine.
Two 3 H. P. Upright.
One 2½ H. P. New Brantford.
One 2½ H. P. Goldie & McCulloch.
Four 1½ H. P. NEW and Second Hand.

Pumps

1 12″ x 7″ x 12″ Northy Duplex.
3 8″ x 5″ x 12″ NEW Duplex.
5 6″ x 4″ x 7″ " "
6 5¼″ x 3½″ x 6″ " "
18 4½″ x 2¾″ x 4″ " "
8 3″ x 2″ x 3″ " "
8″ x 5″ x 12″ Single Acting.
7″ x 4″ x 6″ " "
6½″ x 4⅛″ x 7″ " "
6″ x 4″ x 6″ " "
5″ x 3¼″ x 7″ " "
Several Small " "
NEW Morris Centrifugal, Nos. 2 and 4
NEW Taber Rotary, Nos. 0, 1 and 2.
3¾″ x 8″ pedestal plunger pump.
3″ x 5″ " " "
2″ x 6″ " " "
Several small plunger pumps.

Steam Appliances

NEW Pulsometers Nos. 4 to 7.
8 Steam Traps, all sizes.
150 h.p., Goldie. McC. Heater.
150 " NEW Laurie Heater.
50 " " " "
30 " " " "
40 " " Patterson "
30″ x 96″ Heater.
16″ x 50″ "
18″ x 39″ "

Engine Lathes

1 NEW 32″ x 20′ London.
1 " 32″ x 18′ "
1 30″ x 14″ Heavy bed.
1 NEW 28″ x 18′ London.
1 28″ x 18′ Dundas.
1 NEW 26″ x 16′, also 10′ bed.
5 new 25″, 10′, 12′ and 14′ bed.
8 " 24″ from 10′ to 20 ft.
4 new 21″, 8′, 10′ and 12′ bed.
10 " 18″ " 6′ to 16 ft.
1 24″ x 8′ Dundas.
1 18″ x 6′ in good order.
11 NEW 16″ from 6′ to 10 ft.
2 16″ x 6′ rebuilt.
10 NEW 15″ from 6′ to 10 ft.
4 " 14″ 6 and 8 ft.
3 " 13″ 6 " 8 "
1 14″ x 6′ Dundas.
3 NEW 12″ x 6 ft.
1 " 11″ x 60″ Barnes.
1 " 9″ x 57″ "

Gap and other Lathes

NEW 26″ x 42″ x 14′ Gap.
" 24″ x 40″ x 12′ "
" 30″ x 46″ x 12′ "
" 18″ x 32″ x 12′ "
12″ x 24″ x 60″ Dundas.
22″ x 8′ Chucking Lathe.
18″ x 8′ Davis Turrett Lathe.
16″ x 6′ Fox Lathe.
NEW 15″ x 6′ Fox Lathe.
11″ x 48′ Speed Lathe.
NEW 11″ x 72″ Barues Foot Power.
" 11″ x 60″ " " "
2 " 9″ x 45″ " " "
No. 4½ Barnes " "
9′ x 40″ Cincinnati " "

Iron Shapers

2 NEW 24″ Back Geared Imperial.
6 " 20″ " " "
1 " 16″ " " Cincinnati.
1 " 16″ Single Geared "
1 10″ second-hand Ohio.
1 " 7″ Rhodes.

Iron Planers

42″ x 42″ x 20′ Putman.
NEW 36″ x 48″ x 12′ London.
" 36″ x 41½″ x 10′ London.
" 26″ x 26″ x 8′ Imperial.
4 " 24″ x 24″ x 6½′ Imperial
5 " 20″ x 20″ x 5′ London.
24″ x 24″ x 36″ American.
23″ x 20″ x 5½′ American.
3 Small Hand Planers.

Drilling Machines

3 NEW 100′ Plain Radials.
2 " 72″ Universal Radials.
1 6 Spindle Multiple.
1 4 " "
2 NEW 31″ Barnes.
1 " 28″ "
1 " 24″ Cincinnati, with tapping attachment.
1 NEW 24″ London.
1 24″ in good shape.
7 NEW 20″ Barnes, B. G.
3 " 20″ " Lever Feed.
2 " 14″ Sensitive, Pedestal.
2 " 14″ " Bench.
2 11″ Plain, Upright.
1 NEW 12″ Barnes Friction.
2 " 10″ Friction.
1 " Fox High Speed Drill.
6 Sensitive Bench Drills, NEW.
2 Post or Wall Drills.
8 Blacksmiths' Hand Drills.
6 " " aud Power Drills.

Presses and Hammers

1 No. 45 Power Press, NEW.
5 " 21 " " "
4 " 20 " " "
3 No. 18 Power Press, new.
6 " 19 " " "
1 " 16 " " "
No. 2 Cady Press.
Heavy Bliss Stamping Press.
NEW No. 1, Challenge Soap Press.
Power Draw Press
NEW Erie 400 lb. Steam Hammer.
" 150 lb. Drop Hammer.
2 " 150 lb. Law Power Hammers.
60 lb. Palmer Spring "
NEW 50 lb. Foot Power "
4¾″ x 10″ Steam Hammer.
Several smaller ones.

Punches and Shears

1 NEW 20″ tbroat, London.
5 " 15″ " "
14″ throat, Bertram make.
NEW No. 5, Bremer, Single,
" " 4, " Double.
" " 2, " Siugle.
" " 1, " "
" " 1, " Double.
Large Power Alligator Shear.

Other Machine Tools

NEW No. 1, Cincinnati Plain Miller.
30″ x 6″ x 16″, Stevens Un. "
6 NEW Power Hack Saws.
5 Iron Frame Key-seaters.
NEW 2″ Cutting-off Machine.
" Centreing Machine.
Large Hand Screw Press.
2″ Bolt Cutter and Threader.
NEW 1½″ National Bolt Cutter.
" 1″ Acme " "
" 2″ " " "
4″, Curtis Pipe Machine.
Several Bench and Pedestal Emery Grinders—all sizes.
2 NEW 2½ Ton Portable Cranes.
Crab Winches—all sizes.

Wood Planers

30″ Heavy Smoothing Planer.
27″ Cowan Double Surfacer.
26″ Mc. G. G. " "
24″ " " "
NEW 24″ x 9″ Surface Planer.
24″ Surface Planer, rebuilt.
24″ Pony " "
22″ Surface " "
NEW 16″ x 9″ Surface Planer.
" 12″ Pony Planer.
" 24″ "Handy" Planer and Matcher.
24″ rebuilt " " "
24″ Double Surfacer and Matcher.
NEW 15″ x 7″ Lightning Planer and Matcher.
13″ Fast-feed Flooring Machine.

Buzz Planers

3 NEW 12″ Pedestal.
1 12″ rebuilt.
1 10″ "
1 6″ "
58″ Stroke Jointer.

Wood Moulders

8″ 3 Side Cowan.
7″ 3 " all rebuilt.
6″ 3 " Cant, Gourlay.
6″ Sash Sticker.

Saw Tables

NEW No. 18 Combination.
2 " " 1 Clement, Variety.
4 " Variety Tables.
Dimension Saw Table.
No. 3. S. F. Rip Saw, Ballantyne.
Egan Double Cut-off Saw.
NEW Champion Cut-off Saw.
Cowan Railway " "
4 Wood Frame Machines.
2 NEW Swing Saws.
2 Rebuilt " "

Band Saws

2 NEW 36″ Pedestal.
36″ Pedestal in good order.
NEW 32″ Pedestal.
" 30″ Bracket.
30″ Bracket, rebuilt.
NEW 26″ Pedestal,

Re-Saws

Rebuilt Band Re-Saw, 54″.
40″ Galt Circular Re-Saw.
36″ " " "
Rogers Vertical "

Other Wood-Working Machines

2 NEW Heavy Shapers.
3 Rebuilt Shapers.
Galt Power Mortiser.
NEW Foot Power Mortiser.
Rebuilt " " "
4 Tenoning Machines.
2 Dowel Machines, 1½″ and 2¼″.
3 Dovetailing Machines.
36″ Double Drum Egan Sander
3 Box-Nailing Machines.
7 Blind Slat Tenoners.
Borers and Wirers.
NEW Lath Mill 4 saws.
Waymouth Guage Lathe.
18″ Wood Lathe.
Wood Trimmers, all sizes.
3 Self-acting Shingle Machines.
Swing Shingle Machines.
Shingle Jointers and Packers.

Saw Mill Machinery

2 NEW 3 Block Mills.
3 Rebuilt Mills.
NEW No. 4 Tower Double Edger.
" Tower Trimmer.
No. 1 Gang Edger 3 18″ Saws.
NEW Wood Frame Drag Saw.

Water Wheels

23″ Right Hand Leffel
25″ " " Farrens.
26″ Left " Leffel
30″ " " Perfection.
Water Wheel Governor.

New Cocoa and Chocolate Machinery

One extra sized Milanger.
One 6 roll Refiner.
One Patent Continuous Refiner.
One Triple Mill.
One Gas Roaster, capacity 200 lbs.
One Cocoa Sorting and Cleaning Machine.
One Patent Hydraulic Cocoa Press.
One No. 2 Sifter for cocoa powder.

Also the following:

Electric Motors and Dynamos.
Blowers and Exhausters.
Printers' Machinery.
Laundry Machinery.
Tinsmiths' Tools.
Grist Mill Machinery.
Contractors' Machinery.

CONTRACTORS' MACHINERY I am especially equipped to supply Hoisting Outfits, Pumps, etc., promptly

Prices and details cheerfully given for the asking. Ask for a copy of my latest monthly Stock List.

H. W. PETRIE,

131 to 145 Front St. West,
8 to 22 Station St.

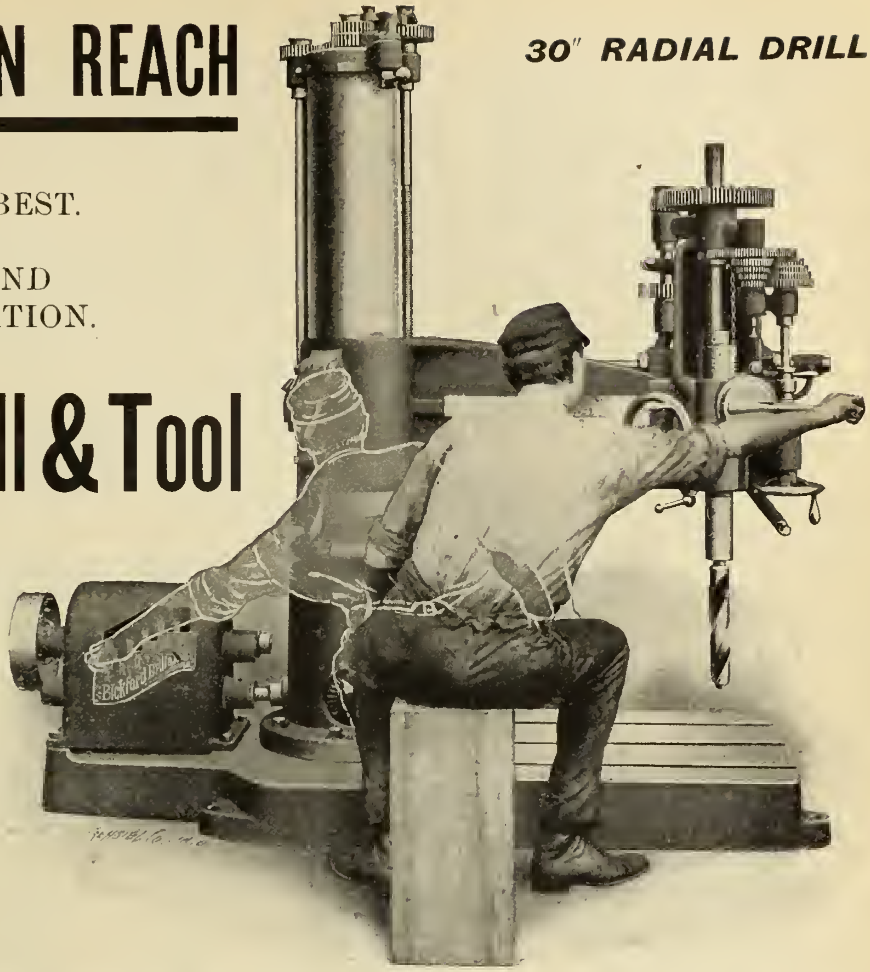
Toronto, Ont.

NEXT UNION STATION

EVERYTHING WITHIN REACH

30" RADIAL DRILL

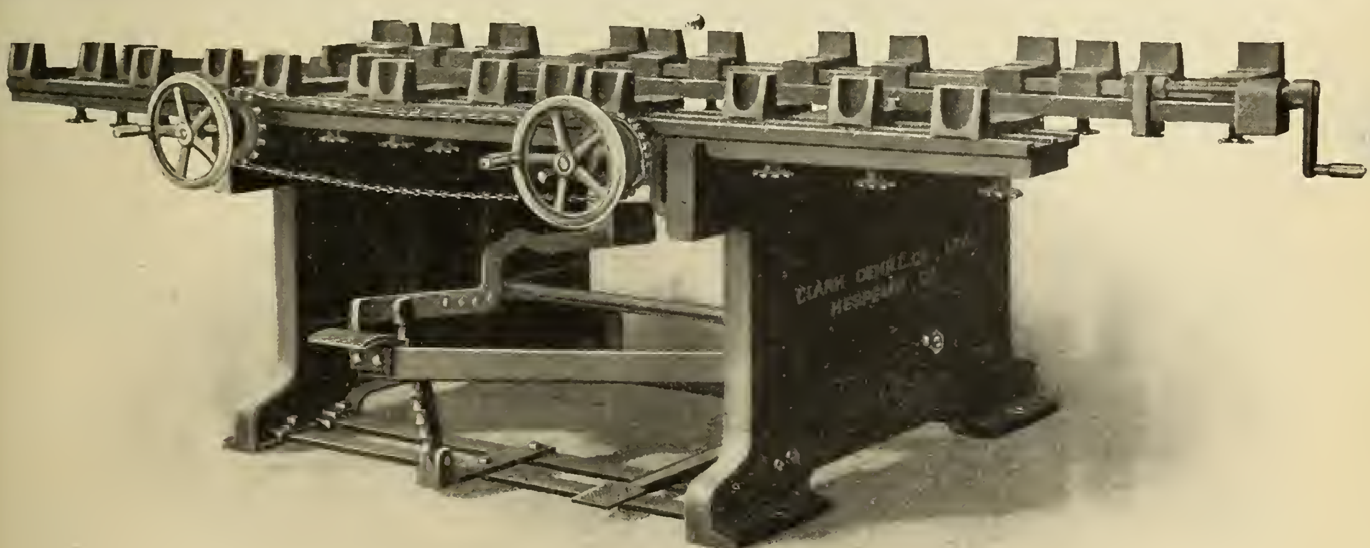
OUR LATEST AND BEST.
A COMBINATION OF
POWER, RIGIDITY AND
EASE OF MANIPULATION.



The Bickford Drill & Tool Company

Cincinnati, O., U.S.A.

FOREIGN AGENTS—Schuchardt & Schutte, Berlin, Vienna, Stockholm, St. Petersburg, New York. Alfred H. Schutte, Cologne, Brussels, Liege, Paris, Milan, Bilbao, New York. Charles Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. H. W. Petrie, Toronto, Canada. Williams & Wilson, Montreal, Canada.



Our No. 213 Improved Heavy Door Clamp

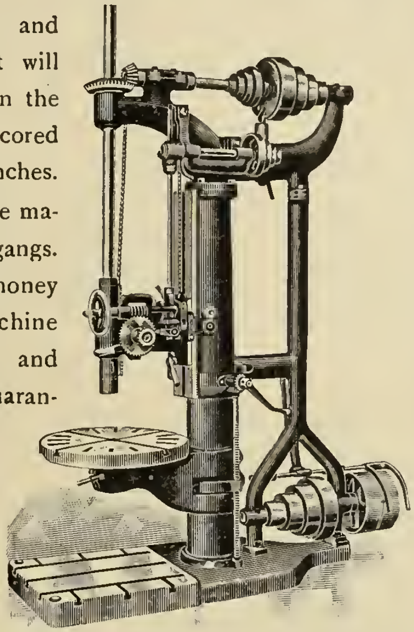
Special features :—Screws moved backward or forward, both together or independently of each other as desired.
Other features which we cannot explain as this space is too small.

Write for Catalogue of Wood Working Machinery

CLARK-DEMILL COMPANY, LIMITED, HESPELER, ONTARIO, CANADA

Successors to CLARK & DEMILL, GALT, ONTARIO.

OUR 31-INCH SLIDING HEAD DRILL



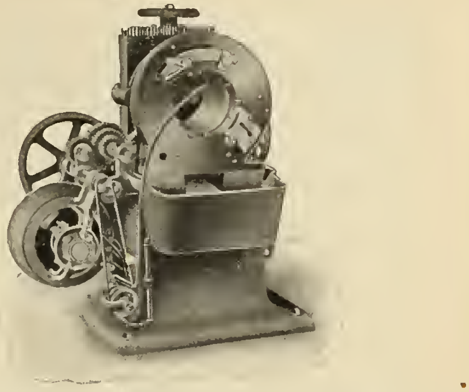
is a very strong and powerful tool. It will drill 3-inch holes in the solid, or bore out cored holes up to 6 inches. Furnished in single machines or in gangs. This Drill is a money maker in any machine shop. Material and workmanship guaranteed. It will give you satisfactory and accurate service.

Details in our Catalogue N.

Carried in stock by our Ontario Agent

***H. W. PETRIE,* TORONTO**

B. F. BARNES CO.
Rockford, Ill.



Motor Drive

Merrell Motor and Engine Driven Machines

We can furnish these machines with motors for any direct current. The vise is self-centring and is actuated by a rack and pinion to feed the pipe into the chasers. The head of these machines can readily be removed from the base and used as portable hand machines. The chasers can be sharpened by grinding and can readily be replaced by chasers cutting any style or pitch of thread, either right or left. The machines are made in four sizes—Nos. 5½, 6½, 9½, 11½.

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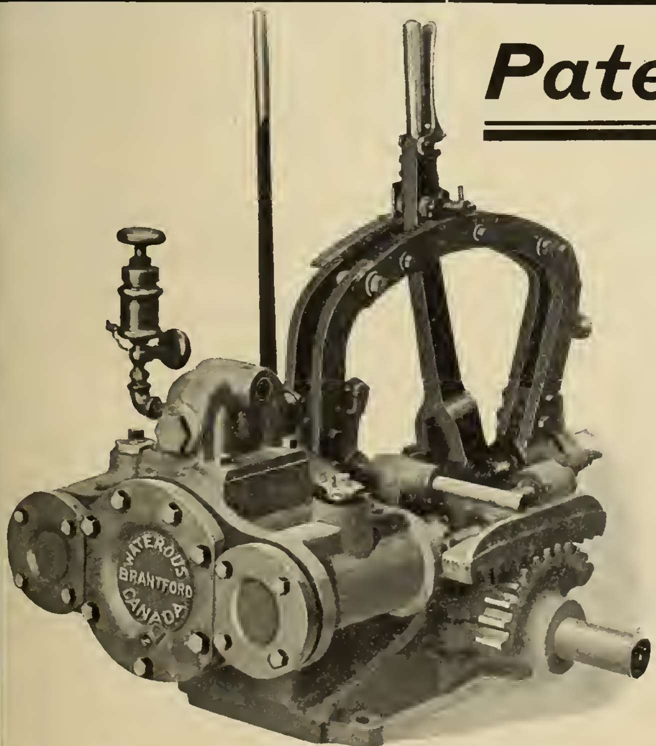
THE CANADIAN FAIRBANKS CO., LIMITED

Sole agents for Canada

MONTREAL, TORONTO, WINNIPEG, VANCOUVER



Patent Steam Setter

Will increase cut from five to ten per cent.

Very Simple
Easily Attached
Very Reliable

The following is what one of our customers has to say about this Steam Setter :

"The Steam Setter which you sold us for this season's cut has satisfied us beyond our highest expectations. After using it for more than six months we are convinced that it has considerably increased our cut of lumber and has more than twice earned what it cost."

Write us for full particulars and price.

THE WATEROUS ENGINE WORKS CO., LIMITED

BRANTFORD, - CANADA

HOW MUCH OF YOUR POWER IS WASTED?

During 1895-96 a series of experiments were conducted by Prof. C. H. Benjamin, of Cleveland, Ohio, to determine the ratio of the power required to drive shafting and belts, to the total power consumed, in 12 manufacturing plants on both light and heavy work. The results were as follows:

TABLES

Manufacturing Plant Number	Total Horse-Power	Horse-Power to Drive Shafting	Per Cent. to Drive Shafting	Manufacturing Plant Number	Total Horse-Power	Horse-Power to Drive Shafting	Per Cent. to Drive Shafting
1	400	157	39.2	7	40.4	20.7	51.2
2	74	57	77	8	74.3	40	53.8
3	38.6	25.3	65.6	9	47.2	24.5	51.8
4	59.2	47.9	80.7	10	190	108	56.9
5	112	64	57	11	107	74.5	69.7
6	168	91	54.2	12	241	114	47.3
Average, heavy machine work	....	....	62.3	Average, light machine work	....	....	55.1

75 per cent. saving is what we guarantee on shaft friction.

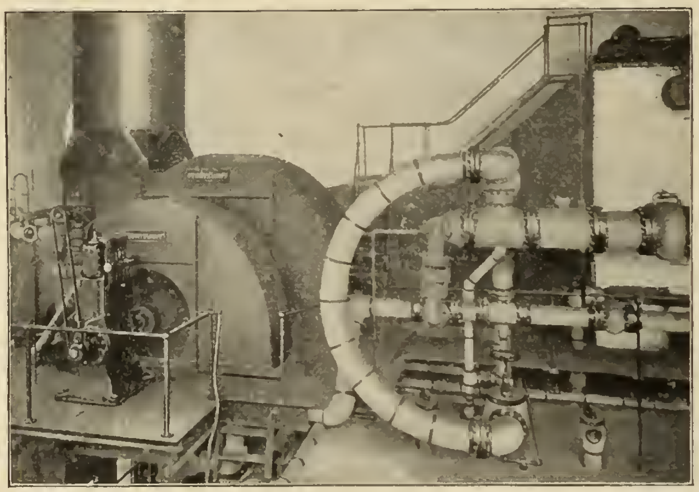
Over 200 of the leading Canadian factories are equipped with Chapman Double Ball Bearings.

Send for catalogues and letters from manufacturers who have them in use.

THE CHAPMAN DOUBLE BALL BEARING CO. OF CANADA, LIMITED

Office—39 Scott Street. Factory—39 Pearl Street, Toronto.

MECHANICAL DRAFT FANS



The efficiency of a mechanical draft plant depends upon the design and application of the fan. If too small to deliver the required volume without exceeding the necessary draft pressure, power will be wasted. Only 25 per cent. increase in speed requires 100 per cent. more power. We make it part of our business to see that such matters are not overlooked when our mechanical draft apparatus is installed.

B. F. STURTEVANT CO., BOSTON, MASS.

General Office and Works, Hyde Park, Mass.

New York Philadelphia Chicago London

Designers and Builders of Heating, Ventilating, Drying and Mechanical Draft Apparatus; Fans, Blowers and Exhausters; Steam Engines, Electric Motors and Generating Sets; Fuel Economizers, Forges, Exhaust Heads, Steam Traps, Etc. 518

RETURNED
AUG 15 1906

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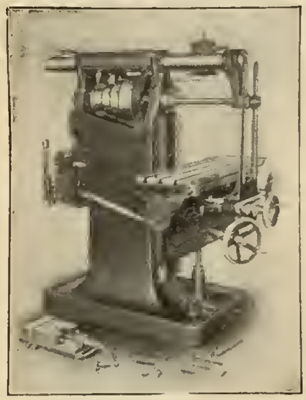
page 73

Becker-Brainard Milling Machine Co.

OF

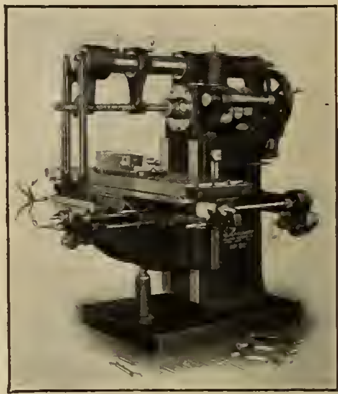
HYDE PARK, MASS.
U. S. A.

No. 3



When you see that name you know that it represents all that is desirable and necessary for the make up of a practical, durable, money-saving and money-making milling machine.

It is the real merit of our products that has built up the largest milling machine business in the world. We have an attractive catalog which will give you the details in regard to dimensions, etc.



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WRITE FOR IT. DON'T PUT IT OFF.

Becker-Brainard Milling Machine Co.

TURRET PUNCH

(Patent Applied for)

THE ONLY PUNCHING PRESS

on the Market that will punch holes from 1-8 to 1-2 in. in heavy band iron without changing Punches.

Strong and easily operated

WRITE FOR PARTICULARS.

TAYLOR & McKENZIE

General Machine Shop. Guelph, Ont.

AGENTS WANTED.

My Product Consists of:

A FULL LINE OF

Sensitive Drills

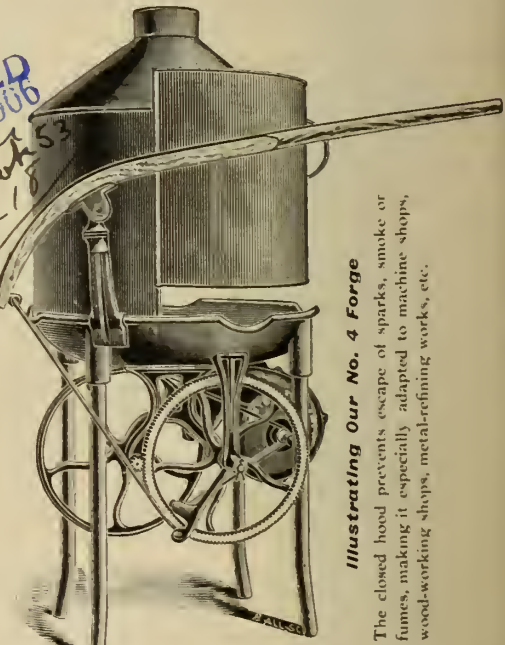
with most any number of spindles,

With or Without Power Feed

Bench Drills that Drill up to ½-inch holes. Clamp Drills, 2 styles, 4 sizes. Track Drills. Upright Drills for hand or power for blacksmiths. Planer Chucks, 16 sizes. Nut Tappers for ½-inch nuts and under. If interested send for Catalogue.

FRANCIS REED CO.

43 Hammond St., WORCESTER, MASS.



Illustrating Our No. 4 Forge

The closed hood prevents escape of sparks, smoke or fumes, making it especially adapted to machine shops, wood-working shops, metal-refining works, etc.

The most complete line of Portable Forges in the market, for variety of sizes, and in manner of operating with gear or by clutch.

Manufactured by

BOYNTON & PLUMMER, WORCESTER, MASS. U. S. A.

To Montreal
cut Book 44
page 29

FAIRBANKS-MORSE FOR ALL PURPOSES

PUMPS

The above illustration shows the Fairbanks-Morse Duplex Plunger and Ring Pattern Low Service or Tank **Pumps.**

These Pumps (Low Service or Tank) in the larger sizes are made of the plunger and ring pattern, as illustrated by above cut. The valve arcs are large and the water passages very direct. All stuffing boxes are large and deep, and all interior parts of the valve chamber may be easily reached **through conveniently arranged hand holes.**

Fairbanks, Morse & Co. are continually adding to their already extensive line of patterns, and we are prepared to offer a pump suitable for almost any service to which direct acting pumps can be applied.

Fairbanks-Morse Duplex Piston Pattern Low Service or Tank Pump.

WE CAN SUPPLY ANYTHING IN THE LINE OF PUMPING MACHINERY

Send for Pumping Machinery Catalog.

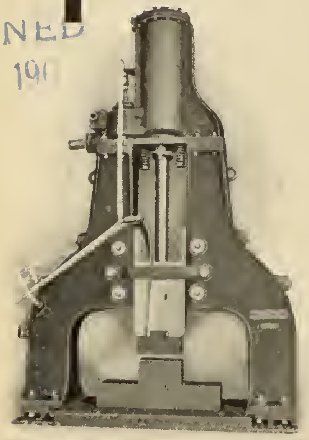
THE CANADIAN FAIRBANKS COMPANY, LIMITED

MONTREAL TORONTO WINNIPEG VANCOUVER

ANNOUNCEMENT

BY

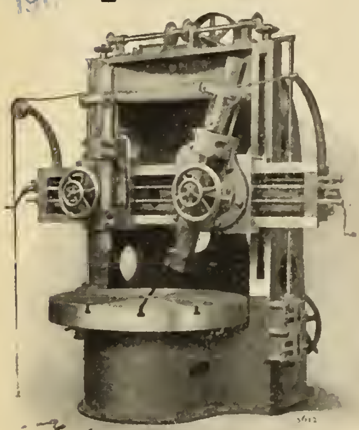
Canada's Leading Machinery and Supply House



The John Bertram & Sons Co.

It is with great pleasure that we are enabled to announce that arrangements have been made whereby we become the Sales Agents for this company.

Messrs. John Bertram & Sons have long been known as the leading Canadian machine tool builders, and the product of this company has been well known, not only in Canada but all over the world, and has reached a standard which has placed them in the front ranks of machine-tool builders in any country. They have recently become identified with The Niles-Bement-Pond Co., and with the facilities afforded by this connection will be able to offer to the Canadian Public the very latest and best machine-tool construction. We shall from time to time illustrate in this monthly the product of this company.



NEW CANADIAN INDUSTRY

Canadian Pratt & Whitney Co.

Pratt & Whitney tools are known the world over, and their name stands for the highest grade of workmanship and material. They have recently purchased a plant in Dundas, Ont., and will shortly place on the market, through The Canadian Fairbanks Co., Limited, a full line of Taps, Reamers, Dies, Milling-Cutters and both High-Speed and Standard Twist Drills. Full stocks of these will be carried at our warehouse in Montreal, Toronto, Winnipeg and Vancouver, and we shall especially solicit contracts for furnishing supplies of this kind on a yearly basis.

Pratt & Whitney High Speed Drill.

Enquiries Respectfully Solicited.

THE CANADIAN FAIRBANKS CO., Limited

MONTREAL TORONTO WINNIPEG VANCOUVER

Modern Canadian Manufacturing Plants.

ARTICLE X.—Motor Car Department, Packard Electric Co., St. Catharines.

IT is only a year since work was first commenced on the buildings that now constitute the motor car department of the Packard Electric Co., St. Catharines, and since that time the capacity of the new department has been doubled by extensive additions to the plant as originally designed. The automobile works is a branch or department of the Packard Electric Co., and is under the same control and management, the car manufactured being the well known Oldsmobile. This is the first plant in Canada to be built and designed for the manufacture of automobiles, and in starting this the company exercised faith in the future of the automobile trade, as well as in the growth and development of Canada. Until the present the automobile trade has been constituted largely from purchases for private use ; in fact it has been a pleasure vehicle, and as such its sales to a large extent have been governed by the good times prevailing here. While this condition is still maintained it will not always be so. The great future for automobile lies beyond present demand. It will be the outcome of a development in freight and haulage by motor cars, a condition that is fast materializing in some of the large cities in the United States. The utility of an automobile as a freight or parcel carrier has already been recognized and although its advent has been slow it is certain to materialize.

As is well known the manufacture of an automobile requires as fine work as probably any mechanism. The component parts must be of the best material and the workmanship of the latest that human skill and ingenuity have devised.

The plant of the Packard Electric Co. is shown herewith in plan, a glance at which will show the part of the buildings devoted to the automobile trade. The main feature of interest centreing about this department is the machine shop, in which are found some of the newest and best designs of machine tools in their particular line ; in fact, when the installation was made three-quarters of these tools were the first of their kind in Canada, and in nearly all cases they are special tools bought solely for the special work to be demanded of them.

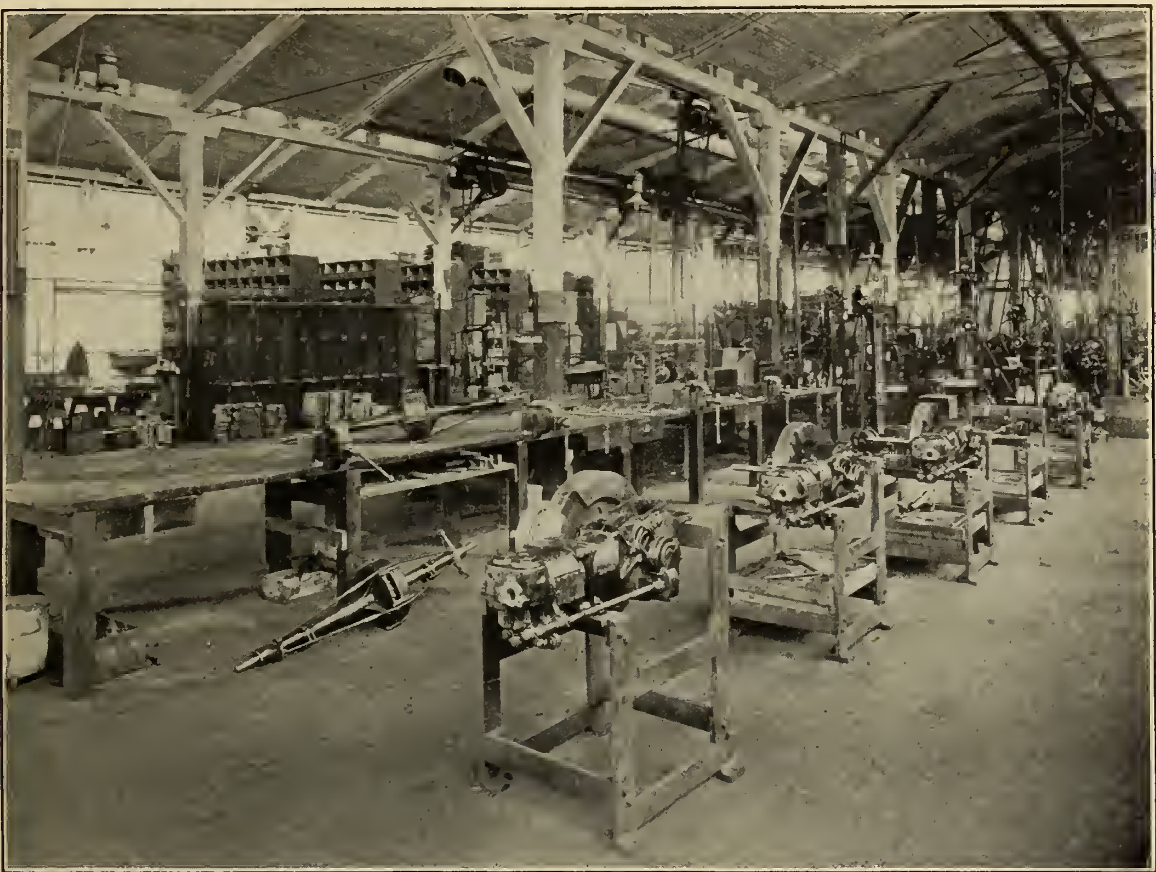
Buildings.

The buildings are of solid brick on stone foundations. From about 4 feet upwards to the roof the walls are practically all glass, giving abundance of light. The interior is of slow burning mill construction, the walls and ceiling being painted white, which together with additional windows in the saw tooth roof makes one of the brightest shops to be found. The list of buildings includes the machine building and general assembling, upholstering building, the store room, blacksmith shop, which

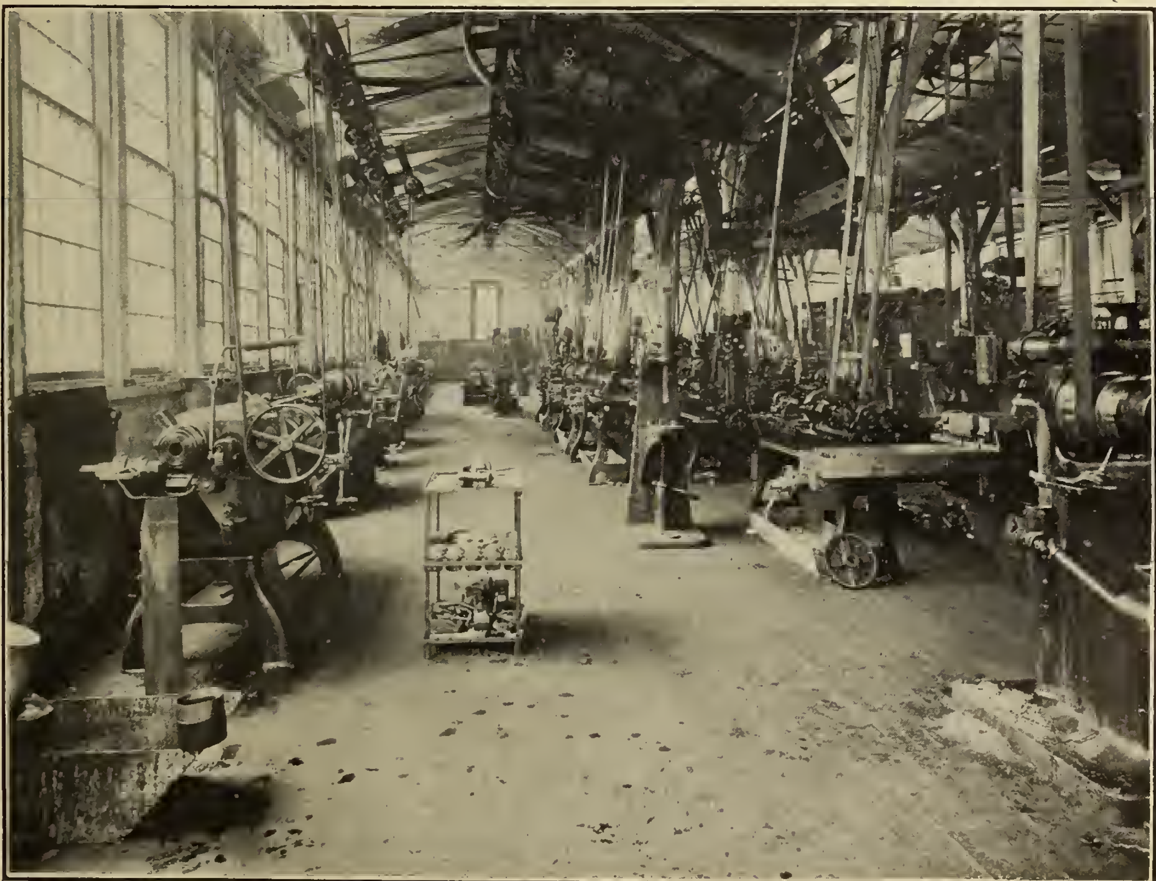
Motor Car Department, Packard Electric Co.—Bird's-Eye View.

Machine Shop, Packard Electric Co.—Motor Assembling Room.

Machine Shop, Packard Electric Co.—Axle Assembly.



Machine Shop, Packard Electric Co.—Showing Finished Stock Room.



Machine Shop, Packard Electric Co.—North Bay.

includes the brazing and enameling departments, and oil house.

Machine Shop.

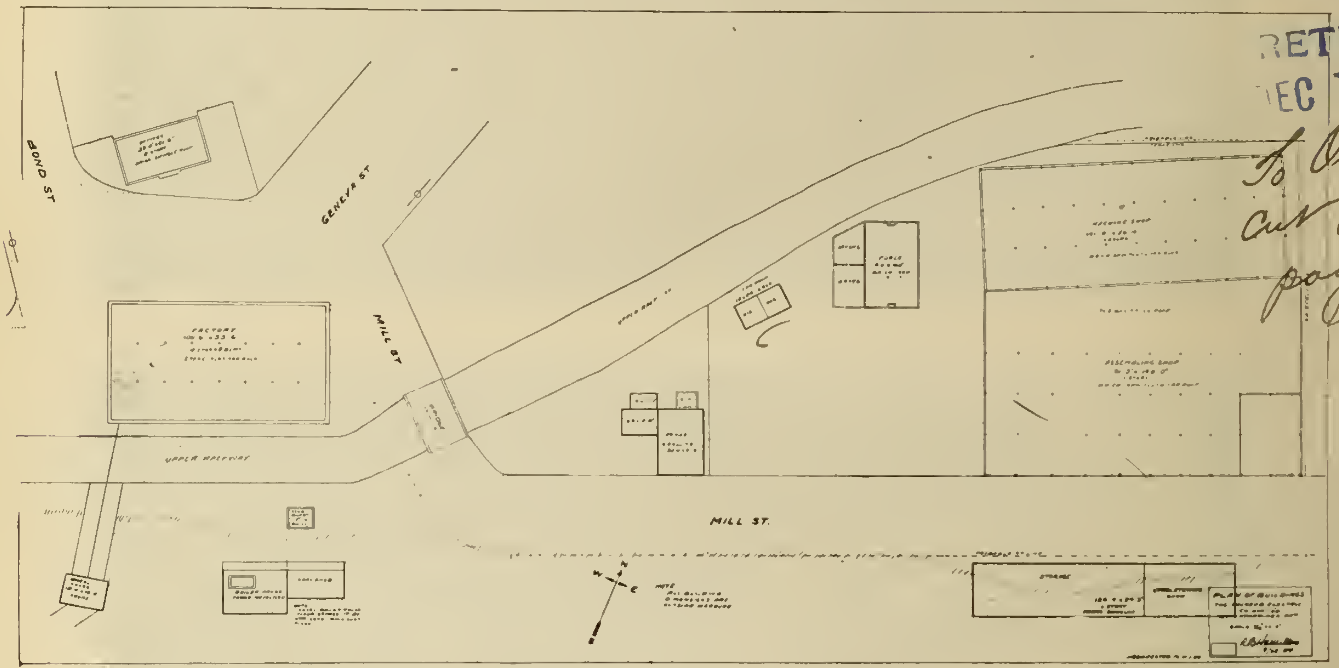
As mentioned before the main interest to readers of Canadian Machinery is centred about the machine shop. It is a model of its size, and any machinist working here would have an abundant chance of learning many details of his trade probably not afforded in many other shops. This shop is under the same roof as the general assembling shop, but is separated from it by a party wall. The different departments of the machine shop include the rough stock room, where all the material entering the machine shop is stored, the finished stock room, where the different parts manufactured in the building are taken, and where the parts purchased outside already finished are stocked before going to the assembling room, as well as the tool room and motor assembling floor. The finished stock room is the distributing centre for every part that goes to make up the finished automobile, and occupies a large portion of the right hand bay of the machine shop, and is fenced off by heavy woven wire partitions from the main shop, as is also the rough stock room and the tool room.

The tool room is situated about the centre of the right hand side of the machine shop between the two stock rooms. It is used for making all tools for the construction of the car. From this department tools are given out to the workmen, the check system being used so that any tool may be located at any time. It is used to a considerable extent for making jigs, and these, as anyone connected with the machine shop knows, must be absolutely correct, and particularly so when used in fine work such as is demanded in these lines where the workmanship must be without fault and the measurements unvarying. The principal machines in this room are three Cincinnati milling machines for milling reamers and special cutters, also used for a large variety of jig work, especially when the various holes in the jig require particularly careful locating. There is also a Lodge & Shipley tool room lathe 14 inches by 5 feet with taper attachment, and one LeBlond 15 inches by 8 feet with relieving attachment for forming cutters, a Washburn drill grinder, Dwight Slate drill press, Cincinnati Universal tool and cutter grinder, and a Gould & Eberhart 20-inch shaper for general tool work. The machine shop work for the season has been completed and already arrangements are in progress for next season's output, the development of the automobile necessitating the building of a large number of new tools, etc.

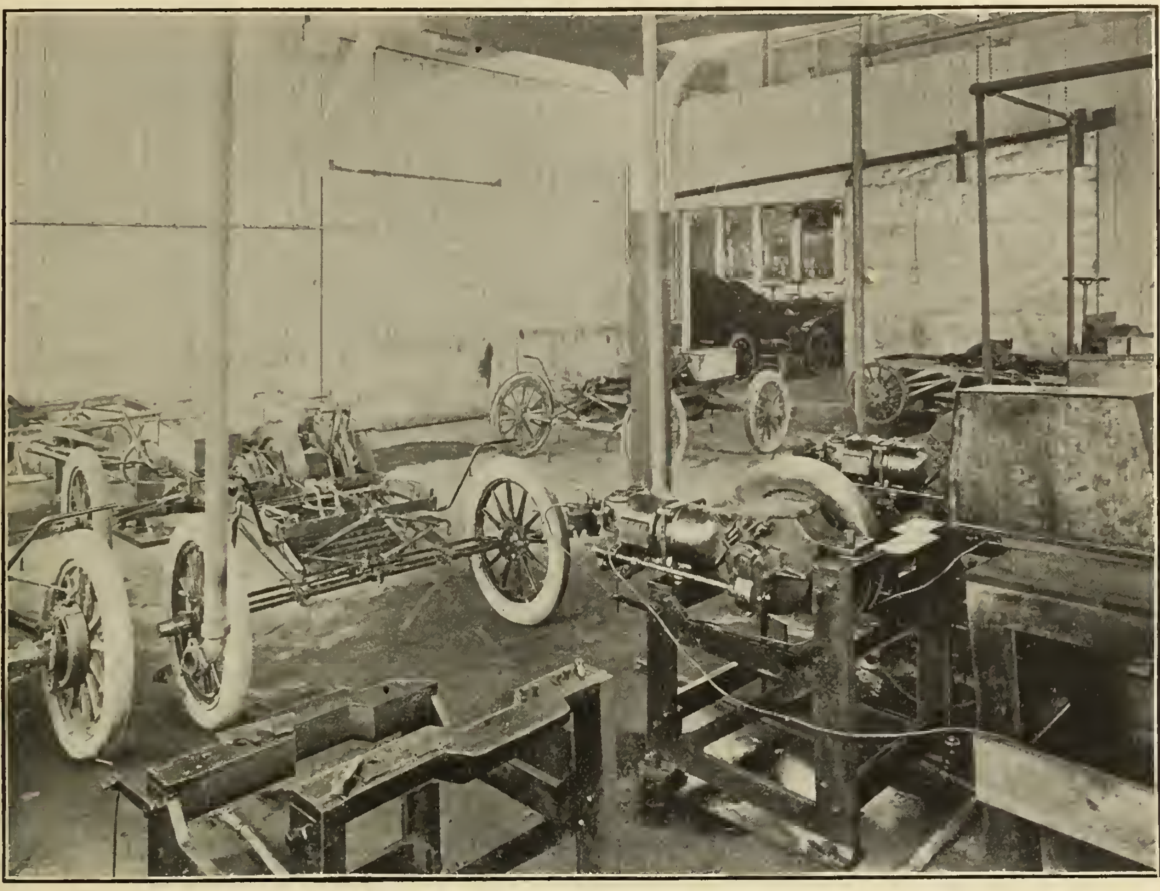
In deciding the method to be used in driving the machine tools, the fact that most of the tools used in the machine shop are light had to be considered. Placing a separate motor on each machine would have involved considerable useless expenditure, hence it was decided to run two lines of shafting, each supplied with power from a 35-h.p. induction motor, taking current from a Crocker-Wheeler generator in the company's main power plant. The buildings are heated by the air blast system, by which fresh air is forced by a fan through a nest of steam pipe coils and then distributed by large overhead pipes to all parts of the shop. The fans are driven by electric motors, and the steam is supplied from the main boiler house. The heating equipment was designed and supplied by Sheldon & Sheldon, of Galt, Ont.

To get some idea of the class of work done here and of the equipment it may be well to follow the cylinder casting from the time it enters until it leaves the shop. The first operation is to centre and centre-drill the head end, which is done in a Cincinnati drill press. The piece is then taken to a 24-inch Lodge & Shipley all-geared lathe, where it is chucked and turned to fit the crank case. It is then returned to the Cincinnati drill press where the four holes for securing the cylinder to the crank case are drilled and reamed in a special jig. The cylinder now goes to a Lucas boring mill, where it is bored with three cuts. After the first two are made the cylinder is set aside to cool, and when sufficient time has been allowed for this the finishing cut is taken with special sizing reamer. It now goes to a 24-inch Lodge & Shipley lathe and is counterbored, from which it is taken to a No. 3 milling machine, where the sides and ends are faced by means of large end milling cutter, using high speed steel in the blades. The cylinder is now taken to a 32-inch Cincinnati drill press where it is jig drilled for cam shaft and valve gear, spark plugs and water connection and the valve seats are bored and faced. These operations place the cylinder ready for assembling room.

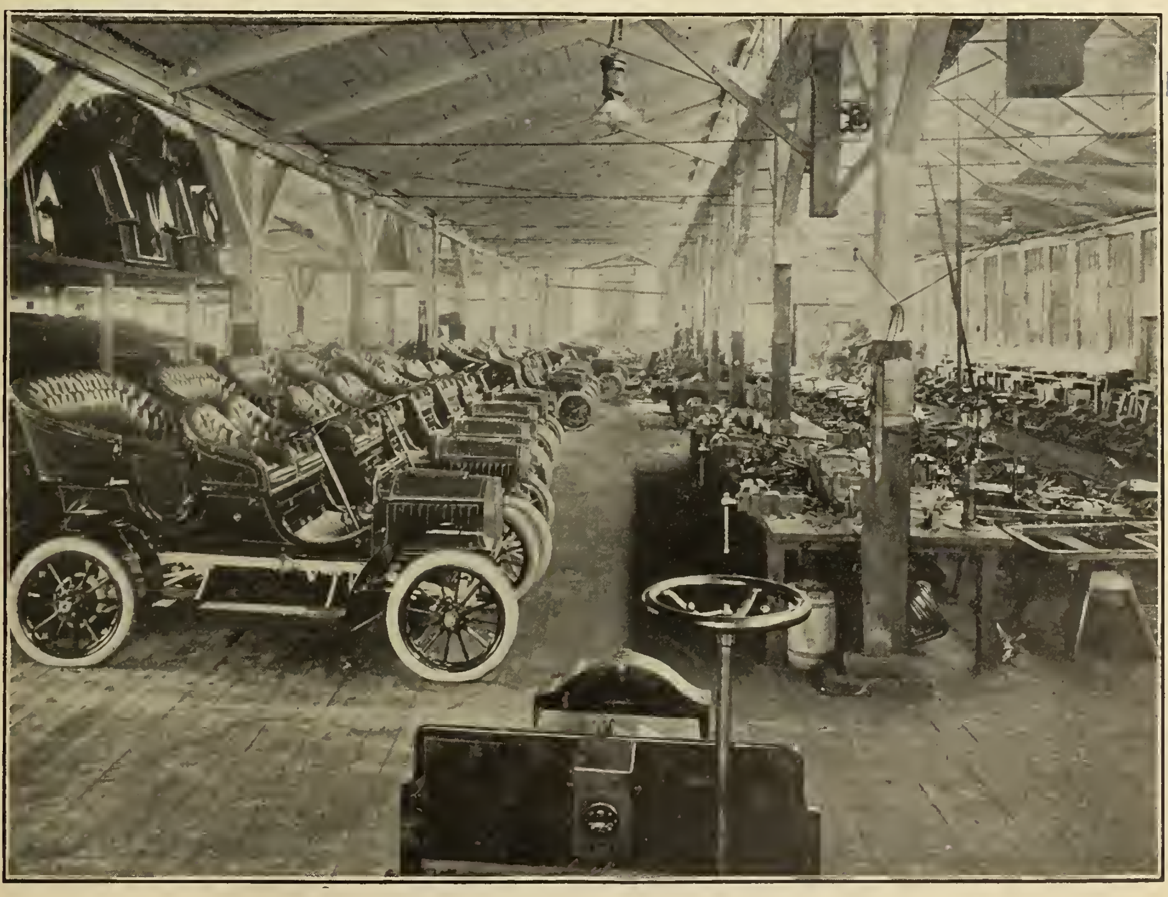
Some of the machines in this shop are worthy of notice. One is a 36-inch Fel-



Plan of Packard Electric Co's Plant, St. Catharines, Ont.



Machine Shop, Packard Electric Co.—Motor Testing Room.



Machine Shop, Packard Electric Co.—Ware-room for Finished Cars.]

Machine Shop, Packard Electric Co.– General Assembly Floor.

Machine Shop, Packard Electric Co.—Shipping Floor.

lows gear shaper made by the Fellows Gear Shaper Co., Springfield, Vt. This tool is of their latest design and is especially adapted for cutting spur gears for motor cars. This is said to be the only tool on the market that will cut the spur gear theoretically correct. This tool is now used constantly for every automobile turned out, and for each makes 12 gears and two sprockets. Another special machine is a 2 by 24 inch Jones & Lamson turret lathe with cross sliding head for bar stock and chucking work. It is brought into use for making special tools and studs, also for general chucking work, both in cast iron and drop forgings. Another lathe of the same firm is a sliding head chucking machine used entirely for this purpose. A Landis grinder is used for working on the shafts and pistons besides tool making. Another special machine is the power cutting off machine made by Cochrane-Bly Co., Rochester, N.Y. This is a circular cold saw, and cuts bar stock up to 4 inches in diameter and is one of the greatest labor-saving devices installed. A Baker Bros., Toledo, key seater does useful service on fly wheels and drop forgings. A No. 1 Lucas 15-ton power press presses the fly wheels on the crank shafts, and is also used for broaching. In addition to these there are one No. 2 Cincinnati Universal milling machine, three No. 3 Cincinnati plain milling machines, besides nine drills, eleven lathes and two screw machines, and a bolt cutter. The lower end of the machine shop is used for assembling the motors.

Other Departments.

In the blacksmith shop are to be found three power driving apparatus used for making frames, besides a large variety of tool work. Adjoining this is the enameling department, where the parts are enameled, and the brazing department. In the upholstering department the seats and tonneaus as they are received from the paint shop are upholstered with the very best leather and hair padding, while the cushions are upholstered with leather, hair padding and springs.

Assembling.

Before the motors are brought to this department they are taken to the testinb room where they are run by their own power about 15 hours, when they are allowed to take their place in finished machines in the assemhling room. When they are brought here they are assembled in the frames. The chassis being completely made up, it receives a priming coat of paint and is fitted with testing body and wheels. The machine is then placed on the road in charge of an expert to run it in all conditions of road and weather. After it has had a thorough work-out, averaging 150 miles, and has been gotten into perfect adjustment and good running order, the rough testing body and wheels are removed and it is taken to another room where it is thoroughly cleaned and receives its finishing coats of paint and varnish. After this is done the body, fenders, new wheels, etc., are fitted to the machine and it is ready for shipment.

While the main building of the Packard Electric Works is not new, there is a great deal in it of special interest on account of the fact of its modern design and recent installation. Among the features noticed in the transformer department were a number of special winding lathes for winding transformer coils. They were designed by Mr. R. B. Hamilton, the general manager of the company, and are great labor savers. The ease of control is a special feature, the starting and stopping being effected by a foot lever to which the machine responds instantly. They are in constant operation and turn out a large amount of work. Another interesting feature of this department is a large testing switchboard, specially designed for testing transformers. A fuller description of this will appear in a later issue.

In the meter department are a number of interesting automatic screw machines which embody some new features. One of them operates on four bars of stock at one time, a different operation being performed on each bar.

A number of new devices are used in connection with the incandescent lamp department, where several thousand lamps are turned out each day, the work being very largely done by automatic machinery.

While the many interesting features in connection with this plant have been barely touched upon, as it would require more space than is available to give proper attention to its different features, probably enough has been said to give some idea of the plant of the Packard Electric Co. at St. Catharines.

Practical Mechanics

BY W. H. RAEBURN

Article III. A descriptive discussion of an important subject, simply and clearly stated. Every article of this series should be read and studied by all readers of Canadian Machinery. They are practical and helpful.

Friction.

WE cannot leave an important subject like this of friction without a few more words, so in this article we shall endeavor to make clear some of the practical experiences in this line.

We have mentioned ball and roller bearings and the great saving of power that their use effects. We have just made an experiment which will no doubt be of interest, proving as it does the great efficiency of a ball thrust bearing. The object in performing the experiment was to ascertain the difference in power required to rotate a piece subjected to end pressure with either a plain or ball bearing.

Importance of Bearings.

Fig. 1 shows the apparatus used; from it we see that if the thumb nut is operated until the spring balance registers 50 pounds, there will be 500 pounds pressure on the upper steel collar and therefore on each successive collar below, including the two sets of balls. A clamp (Fig. 2) was secured to either the upper or lower disc as desired and at a point four inches from the centre of disc there was attached to the arm of the clamp, a wire, the pull on which to produce rotation of the disc, was carefully measured. In the case of the upper or plain bearing, this pull was found to be 24 pounds, while only five ounces was required to rotate the lower disc. The greater pull was measured with a spring balance, and the less by means of a cord running over a small pulley carried by conical points, and having the necessary weight suspended to it.

The rubbing surfaces were oiled, but as is well known an end thrust bearing is not easily kept well lubricated without special devices, and there being nothing of that nature it is not surprising that the co-efficient of friction as calculated from the results obtained was found to be .17 between the steel collars and brass disc. Just here an important point should be noted.

Results of Experiment.

The formula for calculating the coefficient of friction, from the information

we have obtained in this experiment, is rather ahead of these articles, but we shall state this much about it: That the pressure, or load, under which we are rotating the brass disc between the steel collars or the steel disc between the ball

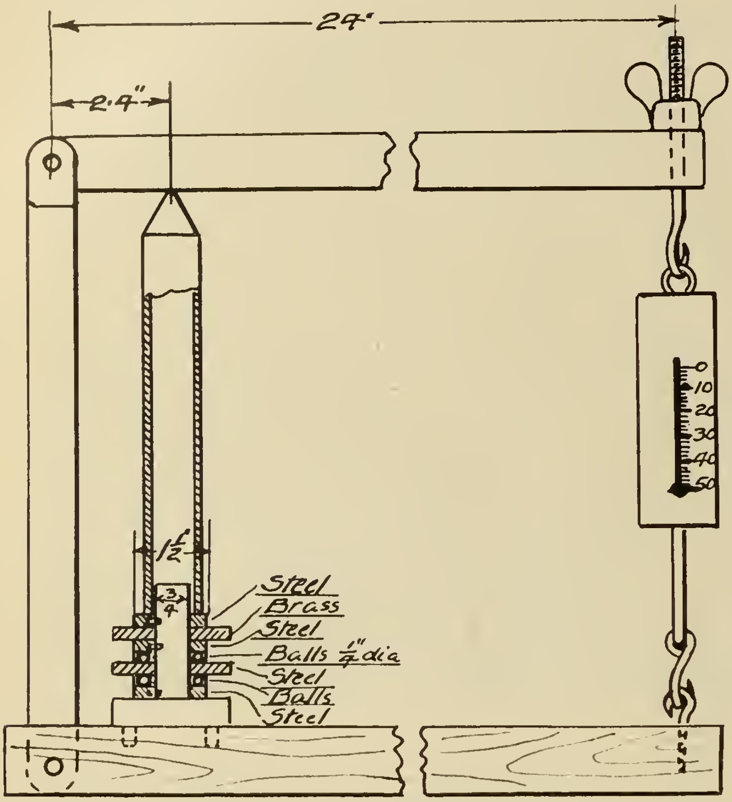


Fig. 1.

sets, must be considered as 1,000 pounds. This seems paradoxical after the statement that friction is independent of surface in contact, but we should notice that at each plane of contact there is a pressure of 500 pounds. Take the upper bearing, for example; the downward pressure where the steel collar bears on the brass disc is 500 pounds, and this must be resisted by an upward pressure of exactly the same amount acting through the lower steel collar against the brass disc.

Let us suppose that instead of the steel collar below the disc being prevented from rotating on the central stud, it were free to do so, being secured to the disc; it would then revolve on the ball bearing below, and we can easily imagine that the power required to rotate the disc would be much less than with the lower collar stationary, not because we have reduced the surface in contact, but because we have reduced the co-efficient of friction on one side of the bearing at least.

Illustrating a Principle.

In Fig. 3 is shown a simple experiment which any reader can make and which illustrates the matter very clearly. This principle is embodied in friction clutches and brakes and is not by any means of recent application, for in Goodeve's Principles of Mechanics, 1885, is illustrated a friction coupling (Weston's) essentially the same in principle as a recent production of one of our manufacturers, and we believe a very efficient clutch.

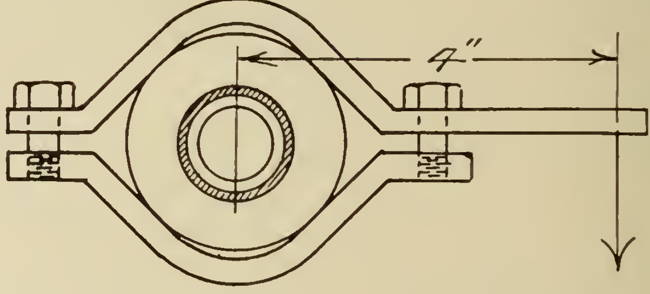


Fig. 2.

Referring to Fig 3, a number of strips of wood are placed on each other, each alternate strip being secured to the fixed piece A, while the others are provided with means for pulling them from between the stationary strips. A weight W is placed on the top of the pile, and if we make this weight 100 pounds and assume the co-efficient of friction between the strips to be .35, we shall find that it requires a force of 70 pounds to pull any one of the three movable strips from between the others. Thus, if the number were increased a very great force would be required to overcome the friction caused by the weight. As explained before, the pull on one strip overcomes the friction caused by the downward pressure of the weight

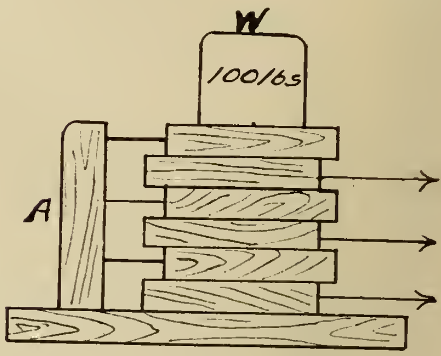


Fig. 3.

on the upper surface and the upward pressure of the reacting force on the lower surface of the strip. Conceive one set of strips to be of suitable force, and secured from rotating on a shaft passing through them, while the other set is secured to a casing or shell surrounding them; we have now the elements of the friction clutch and can understand how a comparatively small end pressure produces so much friction between the discs.

Co-efficients of Friction.

Many experiments have been made for the purpose of ascertaining the co-efficients of friction between various substances, the most frequently quoted authority being Morin. Widely varying data are apt to confuse the student, who

(*Continued on Page 499*)

ENGINEERING NEWS

AND BUSINESS NOTES

SOCIETY OFFICERS.

Canadian Society of Civil Engineers.

Officers for 1905: President, Ernest Marceau, Montreal; treasurer, H. Irwin; secretary, C. H. McLeod. Rooms: 877 Dorchester St., Montreal.

Engineers' Club of Toronto.

President, R. F. Tate; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms: King St. W., Toronto.

Canadian Mining Institute.

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Toronto Branch A. I. E. E.

Chairman, H. A. Moore; vice-chairman, R. G. Black; secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Engineers' Society S. P. S.

President, J. P. Charlebois; recording secretary, E. C. Ash; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriss.

Canadian Electrical Association.

President, A. A. Wright, M.P., Renfrew, Ont.; vice-presidents, R. G. Black, Toronto, John Murphy, Ottawa; secretary-treasurer, C. H. Mortimer, Confederation Life Building, Toronto.

Canadian Association of Stationary Engineers.

President, F. J. A. Sculthorp, Hamilton; vice-president, Wm. A. Sweet, Hamilton; secretary, Wm. Inglis, 554 Bloor St. West, Toronto; conductor, Wm. Outhwaite, Toronto; doorkeeper, Ed. Grandbois.

Ontario Association of Stationary Engineers.

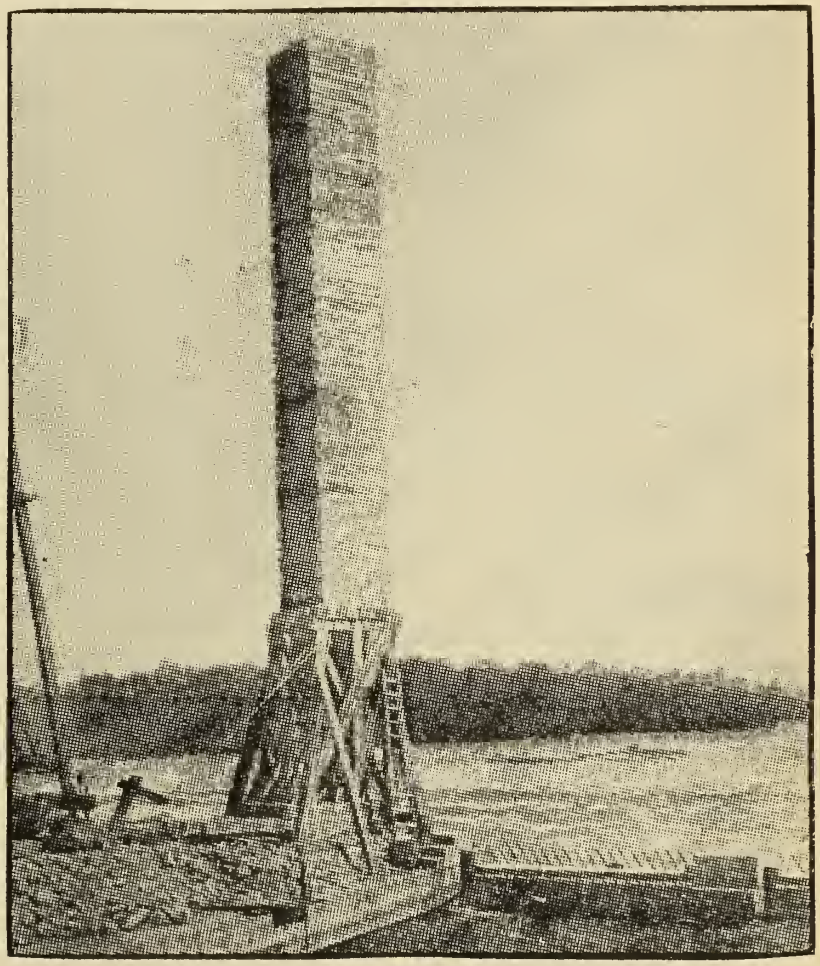
President, Geo. Fowler, Toronto; vice-president, W. F. Chapman, Brockville; treasurer, Charles Moseley, Toronto; registrar, W. G. Blackgrove, Toronto.

Engineering Feat at Niagara.

A CHICAGO engineer has performed one of the strangest engineering feats yet witnessed at Niagara. The Canadian city of Niagara Falls operates its own water plant, and it has had difficulty in getting enough water at its intake to supply the pumps. This intake is in Victoria Park, where the big power development is under way, and the work on all sides has been very extensive. The park commissioners consulted Isham Randolph, consulting engineer of the Chicago Drainage Canal, and he proposed a remarkable plan, a plan that has excited great interest at Niagara. He suggested that the park commissioners erect a concrete column on the shore of the river at the intake, and when completed tip it over into the river so as to form a dam.

The concrete column has been erected. It is 130 feet high, and stands on a trestle that is twenty feet high above the ground level. The column is 7 1-3 feet on each side. Right through the centre runs a heavy chain, the purpose of which is to hold the six big blocks of concrete together when the column is broken, as it falls, by wooden wedges placed in one side about six feet apart. These wedges are twelve inches thick on the outside, and taper to six inches toward the centre of the column. The chain weighs 300 pounds, and it will be strong enough to hold the blocks together against the current as the water is sucked over the Horseshoe Falls.

This giant column stood for some time near the edge of the Horseshoe Falls, that it might be dried out before the unique operation of pushing it into the falls took place. On Nov. 9 a large crowd, consisting of 7,000 people, watched the spectacle of toppling the huge column into the water. The spirit jacks provided for the purpose did their work and at 4 p.m. the column keeled over with a thud that deadened the roar of the falls, and shook the ground under the spectators' feet. A huge column of water, broken stone and mud rose 30 feet in the air. That the experiment was successful was immediately demonstrated as the submerged dam at once raised the water in the fore bay of the city water works by 10 inches. Such a feat was never before attempted in the history of engineering, and to have such daring execution put into successful operation reveals the brilliance and resourcefulness of the engineer who evolved the scheme.



A concrete dam, built like a column, pushed over into Niagara River.

* * *

Mining Convention.

A convention of unusual interest to the mining fraternity in Ontario will take place in Toronto on December 12. This is really a conference between the Government and delegates from all mining districts in the province, and will be held in the reception room of the Parliament Buildings.

Some time ago the Minister of Lands and Mines, Hon. Frank Cochrane, intimated that the Government desired the views of miners throughout the province with regard to various amendments to the Mining Act contemplated for next Session. Local meetings are being held in all the districts, at which questions are being discussed that will be put into the form of suggestions to the Government, who desire the assistance of the miners in framing their mining policy. The general conference will be composed of the delegates appointed at these meetings.

CANADIAN

MACHINERY

AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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Vol. I. DECEMBER, 1905. No. 12

FORGING AHEAD.

DURING the entire year, which has seen the birth and rapid rise of Canadian Machinery, we have modestly withheld from referring to the subject of the marvelous growth and unquestionable standing attained during the short period of its existence. That we have made good is beyond dispute and, apart from a personal realization of that fact, it has repeatedly been brought to our attention in an unsolicited manner from both advertisers and subscribers from one end of the country to the other. In brief, the rapid growth of Canadian Machinery stands without a parallel in the history of trade journalism in Canada.

It was intended with the January number to increase the size of the paper by eight pages. That increase has already been made. Thus, twice since the first issue, while Canadian Machinery is yet but 12 months old, has it been increased in size. This is somewhat of an index to its material growth, but indicates to no degree the standing attained as a recognized authority on machinery matters, nor its enhanced value to subscribers nor its recognized influence as an advertising medium, all of which have grown in a much greater ratio than the actual increase in size.

In spite of prophecies of failure and hints of foolishness, the MacLean Publishing Co. decided to place on the market a machinery and manufacturing paper of such a standard that it would not only help to maintain the high standing of its other publications, but that it should be worthy of the field for which it was intended. This was the result of the fact that no such paper existed in Canada, that the trade in this country really needed such a medium, as well as unbounded faith in the future of the country, its industrial and manufacturing development and of an assured confidence in the intelligence and willingness to respond on the part of those whom we sought to interest.

Our judgment was flattered when another paper purporting to cover the same field was issued shortly after our first number. In this case the converse of the proverb that the good die young was enacted and our contemporary after six months of infantile livelihood disappeared from the list of published newspapers.

Our readers must not take this as a pompous boast, but as an expression of appreciation of the liberal support without which our existence would be but a shattered memory.

It is said that no man attains his ideal, and the present appearance of Canadian Machinery falls far short of the goal of our ambition. For a yearling, however, it shows great progress and advancement and we humbly hope to make Canadian Machinery still more worthy of your esteem and confidence.

Arrangements have been made with several well known writers for special articles in different branches of the mechanical arts, all of which will be of a helpful and instructive nature.

To our numerous friends and supporters, to our advertisers who have been quick to realize the excellent value of Canadian Machinery as an advertising medium, and to our thousands of subscribers scattered far and near we give thanks, and express the hope that you have been bettered and benefitted by your association with the Canadian Machinery.

A BIG MACHINERY MARKET.

FROM the Department of Commerce and Labor the monthly summary of Commerce and Finance of the United States for August has been received. In looking at the figures showing the exports of machinery and allied lines, it is shown that Canada is the largest buyer of these lines of any country in the world, the best customers for machinery Uncle Sam posssesses. Lists are given showing the exports to the United Kingdom, France, Germany, Netherlands, Other Europe, Central States and British Honduras, Mexico, Cuba, Other West Indies and Bermuda, Argentina, Brazil, Colombia, Other South America, Chinese Empire, British East Indies, Japan, British Australasia, Philippine Islands, Other Asia and Oceania, British Africa, All Other Africa and other countries, and in the majority of cases British North America heads the list in metal working lines showing the valuable field United States manufacturers find in this country. Statistics and lists of figures are not always of the greatest interest, but we presume to present herewith a few items from the vast amount of information given that show to some degree the value of the Canadian market to United States manufacfacturers.

In the line of metal working and wood working machinery, the total amounts were given without specifying the individual countries so that it is impos-

sible to give an idea regarding these, but it is known by those in touch with conditions here that they would amount to more than any other of the lines mentioned. The figures given are for the eight months ending August 31, 1905, and for the month of August.

Electrical machinery interests will be surprised at the fact that from a total of $3,718,467 value of these exported during the former period Canada received $1,292,064, more than a third, and of $405,160 exported during the single month we received $184,073, or nearly one-half. That is, that of all the electrical machinery made in the United States during the month of August for export to all parts of the world, nearly one-half came to this country.

Agricultural implements, cars and parts of cars, electrical apparatus, including telephone and telegraphic instruments, sewing machines, typewriting machines and locomotives, show smaller proportions. From a total of $15,298,339 we imported agricultural implements to the value of $1,093,762 for the eight months, and the month of August shows the amount to be $155,218 and the total export for that month practically the same as Canada's import for the longer period. Other figures are: Cars and parts of cars, total for eight months, $6,315,795, imported to Canada $1,292,064 and for August, total $1,093,825, to Canada $148,825; electrical apparatus including telephone and telegraphic instruments, eight months' total $4,865,368, to Canada $737,442, for August $642,793, to Canada $131,496; sewing machines, eight months' total, $3,875,943, to Canada $212,434; typewriting machines, figures are $3,378,414 and $164,525, and for locomotives $2,725,192 and $216,225.

The few classes for which figures are given show a total of over five million dollars, the value of these seven lines imported by Canadians during the first eight months of the present year.

FILL UP YOUR COAL SHEDS.

A GENERAL strike of the coal miners seems assured for April 1, and a scanty supply of coal means a serious state of affairs for manufacturers. The Iron Trade Review makes the novel and timely suggestion that manufacturers consider the situation and purchase and store large supplies of coal, so that business will not be paralyzed by even a long cessation of mining. As Canadians will be affected to the same extent as U. S. manufacturers, it would be well to have the matter receive some consideration and a glimpse into the future taken.

RETROGRESSION.

"FIFTY-FOUR stone cutters out on strike because their employers placed in their yards a machine to facilitate work and enable them to catch up with orders already far behind," was the rather startling news that greeted the public recently in the Toronto daily papers. Investigations by Canadian Machinery and conversations with the principals proved this seemingly incredible statement to be but true. History tells us that such foolishness existed in the middle ages and later when workmen saw or imagined in the introduction of labor saving machinery the ruination of their trades with idleness and starvation awaiting them; but to have it occur in this day of enlightenment, with the evidence of centuries behind the fact that labor saving machinery and devices have invariably given rise to further labor and more employment, seems beyond belief.

The unfortunate affair referred to occurred on the occasion of the installation of a heavy stone planer in the yards of Nicholson, Curtis & Vick, Toronto. Owing to the large number of orders to be filled and the press of work, the management decided that such a machine was necessary to satisfy large contracts formerly taken. In spite of the fact that the men were assured that no diminution in their number was contemplated they arrived at the conclusion that they and the said machine could not work together. Rather than undergo any period of idleness in their yards the firm consented to make no use of the machine until Spring at least, and the men returned to work a day or two later.

What justified the men in doing as they did has not yet been made clear. Stonecutters are, as a class, an intelligent body, commanding high wages, and it is a marvel that they as a body should take any such narrow view of industrial progress. It is further hoped that before Spring these men will have a proper realization of the position in which they stand in public opinion and decide that it is really to their advantage that the machine over which the present trouble has been made will operate at all times, rather than to their detriment.

A GAS TURBINE UNLIKELY.

WHEN in Western Ontario recently the writer met a man who claimed to have in his laboratory a perfect working gas turbine and as soon as a few details were completed he was ready to start in the world with its announcement. The few details are probably what are worrying him most and which no doubt are the very difficulties which present day science and knowledge have been unable to surmount. On the question of the gas turbine the readers of Canadian Machinery will probably be interested to learn the opinion of Mr. Dougald Clerk, M. Inst. C.E., of England, president of the Junior Institution, and an authority as a gas engine expert. Mr. Clerk after discussing the question fully in his presidential address before the Junior Institution of Engineers, sums up that in his opinion the future outlook for the gas turbine is not favorable, and further expresses the idea that there is little hope for a young man to make a business success, or a name for himself in exploiting any internal combustion turbine, as far as our present knowledge carries us. The subject is a most fascinating one and its solution will no doubt bring about the ideal condition in prime movers. Such being the case many no doubt will be attracted to it, but up to the present time it has entirely baffled the most eminent scientific and mechanical experts of our day.

Canadian Tariff Inquiry

SINCE the Tariff Commission, consisting of the Hon. W. S. Fielding, Minister of Finance; Sir Richard Cartwright, Minister of Trade and Commerce; the Hon. Wm. Paterson, Minister of Customs, and the Hon. L. B. Brodeur, Minister of Inland Revenue, held its first sitting in Montreal on Nov. 11, they have had a busy time considering the demands made and suggestions offered by representatives covering all branches of trade. Many questions of importance to the metal and machinery interests in Canada were brought up. Whether all protests expressed are acted upon or considered at all, the publicity given the different subjects at this time is of great value not only to the manufacturer, but to the general public. It requires a fine sense of discrimination and a keen judgment to decide these important questions, so all the data that can be possibly collected by the Commission will have its value.

Iron and Steel Interests.

A strong plea for higher protection was made by the Dominion Wire Mfg. Co., Montreal Rolling Mills and Peck Rolling Mills. It was pointed out that the United States Steel Co. have a practical monopoly of the Canadian market in barbed and galvanized wire, and that Canada was losing the trade, which is worth $2,000,000 per annum. It was asked that a specific duty of 50 cents per 100 pounds, or not less than 20 per cent., be put on galvanized and barbed wire. In reference to the tariff regarding rolled iron and steel angles, it was requested that no change be made. An interesting point developed showing that the Canadian mills can no longer supply steel billets for the market owing to the great demand for steel rails. Mr. John Milne, of John Milne & Sons, pointed out that mechanical steel tubing should enter Canada at 10 per cent., the same as bicycle tubing, instead of at 35 per cent., the present duty. J. R. Wilson and K. W. Blackwell, of the Montreal Steel Works, complained about certain changes recently made in the tariff. A duty of $7 a ton had been put on steel rails, and there was no corresponding increase upon the manufactured article. The Montreal Steel Works are large manufacturers of steel castings and railway construction material, and they find by reason of this duty it is difficult to compete with tne manufacturer in the United States, who gets his rails so much less than Canadians are compelled to pay. Mr. Blackwell requested that the duty be increased from 30 per cent. to 35 per cent. ad valorem.

At Toronto.

While the keynote of the various sections in Montreal and other places was higher duties on most lines, the talk in Toronto was not so unanimous on this score. Hon. Mr. Fielding, in replying to the address of welcome from the board of trade, observed that above all things the Commission was an open public inquiry, and they desired that any person who had anything to show could come in open meeting and express his views.

Opposition to Tin Plate Duty.

An influential deputation of users of tin plate was introduced by Mr. A. E. Kemp, M.P., who made a strong appeal that no duty be imposed on tin plate, as requested by the promoters of the proposed industry at Morrisburg. Mr. Kemp said that there was not sufficient market in the country to warrant the industry being established. The industry of manufacturing steel had not developed to anything like the extent that it had when the Americans established the tin plate industry.

Hon. W. S. Fielding,
Minister of Finance and Chairman of Tariff Commission.

Sheet Metal Interests.

Mr. J. O. Thorn, general manager of the Metallic Roofing Co., appeared with letters from manufacturers of sheet metal building materials in Oshawa, Preston, Galt and Winnipeg, authorizing him to speak on their behalf. These manufacturers consume at least 90 per cent. of the copper sheets imported into Canada. Their request was that it remain on the free list, as at present, there being no mill in Canada capable of producing great variety of material consumed here.

A protest against the request for a duty on sheet copper was made, signed by the following companies: McClary Mfg. Co., London; Thomas Davidson Mfg. Co., Montreal; E. T. Wright & Co., Hamilton; Metal Shingle & Siding Co., Preston; Pedlar Metal Roofing Co., Oshawa; Galt Art Metal Co., Galt.; Kemp Mfg. Co.; Coulter & Campbell, Metallic Roofing Co., Fletcher Mfg. Co., N. L. Piper Railway Supply Co., Booth Copper Co., Toronto; Winnipeg Ceiling & Roofing Co., Winnipeg; and McFarlane & Douglas, Ottawa.

Agricultural Machinery.

Before the session closed in Toronto many divergent views were presented, deputations of working men and farmers appearing to protest against higher duties on articles consumed by them, while more manufacturers desiring to offset foreign competition joined in the demand for more protection. The Massey-Harris came into direct conflict with the farmers, who had asked that the duty on farm implements be lowered, the companies represented asking the Commissioners to even up all the duties on that branch of industry to 25 per cent. This would affect mowing machines, harvesters, reapers, cultivators, plows, harrows, horse rakes, seed drills, manure spreaders and weeders, which are now taxed 20 per cent. Request was made for a duty on cream separators.

Increase Duty on Castings.

Some re-adjustments of duty were asked by Mr. John Cowan, of the Ontario Malleable Iron Co., Oshawa, but the largest question he raised was a request that the rebate on malleable iron duties on goods exported be discontinued. Mr. Cowan asked that a duty on castings in the rough and upon malleable, iron and steel castings, be made 30 per cent. instead of 25 per cent., and that the duty on malleable iron castings for agricultural implements be increased from 20 per cent. to 25 per cent.

Power and Transmission.

A general duty of 40 per cent., instead of 25 per cent., was asked for pulleys of all kinds for transmission of power, grain elevator machinery, transmission machinery, and finished iron work of all kinds, by Mr. C. F. Wheaton, manager of the Dodge Mfg. Co., to meet the American competition.

A request that steel balls be put on the free list until the demand warrants

their being made in Canada was made by Mr. W. J, Murray, of the Chapman Double Ball Bearing Co., and Mr. T. A. Russell, manager of the Canada Cycle & Motor Co., large users of that article.

Mr. Donald J. McKinnon asked for an increase in duty from 25 to 35 per cent., or a specific duty per horse-power, on gas and gasoline engines, together with the transfer to the free list of such parts imported as are not made in Canada.

Windsor Protest.

An increase from 30 to 40 per cent. was asked by the Kerr Engine Company of Walkerville, during the sittings of the Commission at Windsor, on brass and iron valves and castings, as competition with the United States is very keen. There is a possibility of greater competition from Great Britain, where labor is cheaper than here, but the United States worker can do an equally big business in a much smaller area. Mr. H. O. Kerr, who presented the petition, complained of freight discrimination, and quoted the following rates obtained to-day on iron valves in less than carload lots : Detroit to Toronto, 18 cents; Walkerville to Toronto, 30 cents; Detroit to Montreal, 31 cents ; Walkerville to Montreal, 44 cents.

What Labor Unions Want.

At Guelph the Commission sat in the evening to hear representatives of the Guelph Trades and Labor Council. Their request was to the effect that the duty on mechanics' tools be reduced or entirely taken off, especially in the case where a patent right is granted in Canada and the article is not manufactured in this country; that cream separators be placed in the same position in the tariff as agricultural implements; that the duty on cut and dressed building stone be raised from 20 per cent., in view of the fact that stone in the rough is admitted at 15 per cent.; that the duties be remitted on blank forms, labels, etc., coming to secretaries of local trade unions from the general offices of international unions; that the duty on carpets be raised, there being a general complaint of those employed that work has not been as steady since the British preference was granted; and that in any revision of the tariff articles that compose the absolute necessaries of life, such as sugar, oatmeal, etc., be placed on the free list.

Requests Made at Hamilton.

At Hamilton A. B. Petrie, of the Petrie Mfg. Co., manufacturers of cream separators, asked that these articles should be taken off the free list and be placed under a duty of 25 per cent., and within the action of the dumping clauses. The industry was a struggling one, and was not yet able to satisfy the whole demand. The United States manufacturers, however, were trying to kill it altogether by selling separators in Canada at half the price at which they are sold in the United States.

J. A. McMahon, of the Union Drawn Steel Company, and H. J. Waddie, of the Canada Drawn Steel Company, wanted the duty on cold-drawn steel shafting made 30 per cent. in place of 5 per cent., as at present. This latter duty they did not consider fair, as they were paying a duty of $7 a ton on the raw material.

Other deputations heard by the Commission at Hamilton made the following requests :

Window Glass Machine Company, Cayuga : Refund of duty on plant or increased duty against Belgium on window glass.

Hamilton Gas Light Company : Removal of duty on coal or imposition of two cents a bushel on domestic coke, though they are now paying 8 per cent dividend.

John Bertram & Sons Company, Dundas : An increase of 5 per cent. in duty on tools, machine tools being now 25 per cent. and small tools 30 per cent.

Canadian Westinghouse Company, now employing 650 men, asking that request for duty on brass be not granted, and promising to double their employes in four or five months if industry is not interfered with.

H. Barnard, stamps and stencils : That a duty be placed on name plates on cream separators.

The International Harvester Company not being ready with their case, it was arranged that it should be presented at Ottawa if there was an open session there.

Personal Mention.

With the Growing Time.

"Few men have a more interesting history than has that man getting out of the rig," said one of four machinery salesmen standing at the Toronto Union Station a few days ago.

The others of the party turned to see a stout, energetic man of medium height and about fifty years entering H. W. Petrie's warehouse.

"Who is he ?" asked one of the four, a stranger in Toronto.

"W. G. Harris."

"Harris buys scrap," quoted a third member of the party.

"Yes," answered the first speaker, "and Harris has gone further from the scrap business than any man who was ever in it in Canada."

"What's the story ?" asked the stranger.

"Come to the train and I'll tell you."

After the party had secured their seats in the Hamilton train and when everyone had "lighted up" the story was started.

"It seems only a few years ago, when I was a boy just out of school, that W. G. Harris was only one of a score or more of scrap dealers in Toronto. His place on William street was one of the smallest in the lot.

"They say that from the start he was as keen as the best of them, yet was straight in every deal, which is more than you can say of the most of them. Besides he had nerve and ambition and I know he is most thorough in his methods.

"Evidently there was enough room for growth in the scrap business to keep him busy until about ten years ago. Then he got too big for the one line and he formed the Canada Metal Co., the first idea being to melt down old lead, tin, etc., and to make solder, babbit, etc.

"He had been buying old paper from newspaper offices so long that he had heard a good deal of the trouble the dailies were having with their stereotype metal. He saw this trade would be worth having so he went after it. And got it, too, they tell me.

"The way he went after this business would be a lesson to any young man who wants to get ahead in the world. First he got to a paper having so much trouble that they were desperate.

"He got some of the metal they were using ; took samples back to his shop and started in to find out what was wrong. At this time he had practically no knowledge of metallurgy but he went right to the heart of things, found out what was needed and started experimenting until he had the proper composition and was making a metal that satisfied the first paper.

"Have you ever noticed how much harder it is to get a first order for a good thing than it is to get the second or even the next half dozen ? Well, I understand Harris had more trouble getting the metal right for that first paper than he had for the next ten he tackled. Now he sells this metal to newspapers from Halifax to Vancouver.

"At the same time he was experimenting with solders and babbits. Anyone can make a good tinners' solder, but there are some other lines that call for thorough laboratory work and exact treatment in the shop. One of these is canners' wire solder. Mr. Harris went personally into this problem within the last year or two and one of the canners in the combination told me the other day that they got all their wire solder from the Harris firm and never had a complaint about it. As this trade calls for over sixty tons of solder a year it is more important than you might think.

"The babbit question is one of the toughest nuts in the metal field. It is easy to make babbit, but to make one that is of the right composition and at the same time is always uniform takes all the care, attention and skill that anyone can secure. Harris told me just a week or two ago that he knows he makes a first class solder, but he is going to give the matter his personal attention for the next three months with the view of producing a bearing metal that should be superior to anything on the market. That's what I like about him ; he is not content to make something 'as good as' the other fellow's, he wants to make something better.

"Another line he has branched into is lead pipe and fittings, such as are used by plumbers and waterworks companies. It is no snap to manufacture this line as everything has to be sold under guarantee that it will withstand pressure tests and as the expense of installing the necessary machines and testing is such that only two other companies in Canada have installed them.

"During the present year the Canada Metal Co. has entered another field, quite distinct from anything they had been in till that time. Mr. Harris had got next to the fact that there was room for another galvanizing and tinning plant for jobbing work, so he decided to try his hand there. I don't know how well he has done there, but it's even money he's getting his share of the trade.

"That's enough for one man," commented one of the hearers.

"Not enough for Harris. In addition to his manufacturing he is an importer and wholesale dealer in ingot and pig metals in all lines except iron and steel."

"How about the scrap business ?"

"I don't know, but I understand that he has dropped everything in scrap but metals."

* * *

A Machinery Missionary.

One of the newer names in the machinery field in Canada is that of Mr. Geo. H. Howard, Dundas, whose picture we take pleasure in reproducing on this page. While Mr. Howard has been engaged in the machinery business for many years it is only recently that his name has come before the buying and selling public, as he has been engaged by Potter & Johnson Machine Co., of Pawtucket, and the Cleveland Machine Tool Co., of Cleveland, to handle their Canadian business. His experience in the machinery line has been not only extensive, but extremely varied. Having served an apprenticeship with John Bertram & Sons, of Dundas, as machinist, and wishing to further extend his experience he went with the Niles Tool Co., Hamilton, Ohio. After gaining considerable experience there he went with the Universal Radial Drill Co., and from there went to Philadelphia to the firm of Geo. H. Colket & Co., manufacturers of canning machinery. With this latter firm he became traveling representative, covering the eastern cities. Returning to Canada in 1895 he was engaged by H. A. Lozier as foreman of the tool department of the Cleveland bicycle factory at Toronto Junction. This tool room has been considered the finest in its equipment in Canada, being installed under the supervision and run under the direction of Mr. Howard. Wishing still further to extend his experience, after several years as tool room foreman he became foreman of the Toronto Junction Gasoline Engine Co., where he remained one year. In January, 1904, he was appointed superintendent of the Henderson Roller Bearing Co., and while engaged with this company acted in the capacity of traveler as well.

George R. Howard.

Mr. Howard is doing missionary work in Canada in connection with automatic machinery. He finds in many Canadian plants that great economy would result if such machinery were used, and where up till the present time the management has not seen its way clear to adopt such. Mr. Howard is conducting his campaign with considerable energy and his meeting with no small success in educating manufacturers of Canada to the use of the latest and best in the machinery lines is not only of service to himself but to the country at large.

* * *

Mr. Walter Sadler, of Sadler & Haworth, manufacturers of leather belting, Montreal, is suffering from an attack of typhoid fever, and is confined to the Glengarry Hospital of that city.

* * *

Mr. Frank H. Alfred, formerly chief engineer of the Pere Marquette Railroad, has accepted an important position with the Canadian White Co., the Canadian branch of the great contracting firm of J. G. White & Co., who have headquarters in New York, London and Montreal. Mr. Alfred will have his headquarters in Montreal.

* * *

The Locomotive Machine Co., of Montreal, closed for half a day recently out of respect for Albert J. Pitkin, president of the American Locomotive Company, whose funeral was held in Schenectady the same afternoon.

* * *

Mr. Alfred C. Garde, M.E., Nelson, B. C., one of the members of the Commission recently appointed to inquire into the zinc resources of British Columbia, has just returned from the west. He states that the report of the Commission is in course of preparation. They have been at work for the last two months and a half investigating the zinc deposits, the quality of the ore, and method of treatment. Their work has been so satisfactory that it will be continued by the Department next Spring. The price of zinc has greatly increased of late years owing to its much wider use in the various arts and for electrical and galvanizing purposes.

* * *

Mr. Alexander McKenzie, a well known mining engineer, died at his home, 160 Mance street, Montreal, on November 15. He came to Canada about sixty years ago and actively followed the duties of his profession in various parts of the country until about six years ago when he retired. The news of his death will bring regret to his many friends throughout Canada, especially among the older mining men.

* * *

Mr. C. S. Powell, general agent of the Westinghouse Electric & Manufacturing Company, who has for some time occupied offices at 11 Pine street, New York, has removed to the offices of the company on the 19th floor of the Trinity building, 111 Broadway. The Westinghouse Electric & Manufacturing Company, in addition to their offices in the Hanover building at 11 Pine street, occupy the entire 19th floor of the Trinity building.

Modern Factory Plumbing

By Weston Wrigley

IT is becoming more generally recognized that it pays employers to show consideration for the comfort and welfare of their workmen. In the United States the National Civic Federation has a department with a permanent secretary, who devotes her time to working amongst manufacturers and aiding as far as possible to bring about conditions which will tend to encourage the growth of a better feeling, and the development of more rightful relations between employers and employes.

In Canada this important work has not been taken up aggressively as yet, but in the recently erected model manufacturing plant of the Canadian Westinghouse works at Hamilton a splendid example exists of what can he done in this direction by far-seeing and liberal-minded employers. In the Westinghouse factories a system of plumbing has been installed for the workmen's use, the equal of which does not exist in any Canadian factory. Illustrations are reproduced to show the class of work done.

The heating and ventilating is designed on the plenum system, the air being drawn from the outside by large fans and discharged into the building by means of piping, the foul air finding egress through doors, windows and regular ventilating outlets. The system was installed by Sheldon & Sheldon, Galt. Steam used in the heating system is supplied from a Stirling boiler plant, being piped to convenient centres in each building where the necessary steam coils and fans are located. Besides this steam radiators are installed where deemed necessary. To distinguish the various piping systems in the plant according to their use, such as steam, water, pneumatic, gas, etc., each system is painted a distinctive color, thus lessening danger of accidents.

Toilet Room in Detail Bldg., Westinghouse Works, Hamilton.

There are nine toilet rooms located throughout the works for the convenience of the employes and the illustrations will give a fair idea of the beauty and high quality of the materials installed. Four of the rooms are located in the detail building, two in the office, one in the foundry, one in the pattern shop and one in the warehouse, and in order to save floor space and be of greatest convenience to the various departments served the work is installed on mezzanine floors. There is also an emergency toilet room in case of accidents. The rooms on the various flats are accessible by broad stairways of steel concrete construction, guarded by iron pipe railings of special pattern. These as well as much of the sheet metal work, including a large paint machine, were included in the work done by Messrs. Wallace & Son. Lockers are also available for the uze of the company's employes.

Row of Basins, with Closets in Rear, General Machine Shop, Westinghouse Works, Hamilton.

In the toilet rooms the excellence of the material installed and the general cleanliness being such as to lead one to believe that the location was in a high class hotel or public building. In remarking upon this the Westinghouse representative stated that their experience had been that they could secure a higher class of work from men who were cleanly in their habits than from slovenly employes. It pays, therefore, to set a good example and by adopting a set of rules the employes readily co-operate in the endeavor to improve their working environment. In the room referred to there were eleven open and one closed closets, the former being for general use and the latter for the heads of the department. In addition to this there were six urinals, twenty-four basins and a slop sink, this outfit being practically duplicated in another room set aside for the female employees. Both hot and cold water for the users of the lavatories. As the illustrations show, the

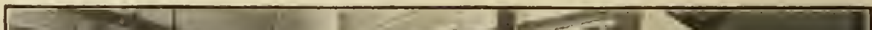
arrangement of the various rooms differs according to the space available and the requirements of the staff. In one case as many as thirty basins are arranged in a row while in the foundry

Wash Troughs in Foundry, Westinghouse Works, Hamilton.

it will be seen that the trough system with running streams of water is used in preference to the individual basins.

The fixture which attracted most attention was the "Arno" Syphon Washdown Closet in universal use throughout the works, it being fitted with the Osborne improved automatic valve and galvanized sealed tank with a water pressure of seventy-five pounds for flushing purposes. A cut of this fixture, supplied by the Standard Sanitary Manufacturing Company is reproduced, it differing, however, from the one installed in the detail that an aluminum seat is used instead of the regular natural oak oval seat. Another neat fixture was the drinking fountain, supplied by the J. L. Mott Company, the fountains being located at convenient situations throughout the buildings.

The specifications called for the installation of sixty of the "Arno" closets, twenty-four "Stevens" urinals, over one hundred basins of the "Omar" type, one wash trough with double sink and two with single sinks, eight slop sinks and five hot water heaters, practically all the material being porcelain enamelled iron and manufactured by the Standard Sanitary Manufacturing Company, Pittsburg, the wash troughs, however, being made by the Standard Ideal Sanitary Company, Port Hope. The work covered included the furnishing, setting and laying of all the soil pipes, waste pipes, vent pipes and floor drains from all the fixtures to their respective traps, branches, and connections to the outside drainage system, and the furnishing of all fixtures and fittings except the slate work. All valves $1\frac{1}{2}$-inch and under were stipulated to be the Jenkins Brothers' Globe Valves.



Toilet Room in Warehouse Westing houseWorks, Hamilton

Reference was made at the commencement of this article to the work of the Welfare Department of the National Civic Federation and in order to outline their plan of propaganda the following extracts from a report of an address recently delivered by Miss Gertrude Becks, secretary of this organization, is reproduced:

"The great value of light and depressing effects of dark work rooms were emphasized, poor light being the cause of many headaches. Ventilation by means of sliding doors in the roofs and the exhaust air system was also alluded to, and the various methods in vogue at different establishments explained. Slides were shown of apparatus employed for removing dust from the foundry sand room, and the advantage of automatic stokes in use at different places was demonstrated. By means of a series of pipes fresh air is supplied to the faces of the workers. Pure drinking water easily accessible is another essential feature. One method of supply was shown where water is delivered at 55 degrees F. and kept in constant circulation.

ON READING.

I fear we do not know what a power of immediate pleasure and permanent profit is to be had in a good book. The books which help you most are those which make you think the most. The hardest way of learning is by easy reading; every man that tries it finds it so. But a great book that comes from a great thinker—it is a ship of thought, deep freighted with truth with beauty too. It sails the ocean, driven by winds of heaven, breaking the level sea of life into beauty where it goes, leaving behind it a train of sparkling loveliness, widening as the ship goes on.

—*Theodore Parker.*

Construction and Improvement

General Construction *Contractors' Supplies*

CONCRETE CONSTRUCTION IN TORONTO.

EVER since the disastrous fire of a few years ago there has been a steady increase in the number of large wholesale buildings of modern type. In many instances large business houses have exercised most excellent judgment in the erection of their new homes in using only indestructible and non-combustible materials. The illustrations herewith reproduced show views and give an idea of the method adopted in the erection of a store and warehouse for Brown Bros. some months ago.

In planning for this building the firm asked for competitive bids upon the whole building for slow burning or mill construction as compared with concrete, and they chose the latter at figures practically the same. The system they chose was that offered by the Expanded Metal Fireproofing Co., Limited, Toronto, and the details of their construction are quite clearly shown in the three illustrations, Figures 1, 2 and 3 given herewith. The walls of the building were of brick, with two lines of columns. The dimensions of the building were 192 feet in length and 42 feet in width, there were four stories and the roof, the heights of same being 10 feet in the basement, and 15 feet, 14 feet 6 inches, 13 feet 6 inches, and 13 feet 6 inches respectively, for the floors above.

The column construction is clearly shown and may be described as having been built of concrete, reinforced with expanded metal and upright bars ; in the same manner the girders and beams were constructed of concrete reinforced with expanded metal and iron bars. The slab of the floor was of concrete and expanded metal only. In Figure 2 is shown the centreing in place during the progress of the work. In Figure 3 is shown an interior view of the finished building. In the construction of the columns and the beams stone concrete was used, while in the floor slabs cinder concrete was adopted. The columns were spaced at distances 16 feet by 12 feet and the building was designed to carry a live load of 300 pounds per square foot. The stairways of the building were encased with 2-foot cementine walls.

Figure 4 reveals the interior of the Dunlop Tire Co.'s factory taken just after the removal of the centreing from the concrete floors. The structure shows brick walls, while the floors and roof are of reinforced concrete ; the size of the building being 200x50 feet, with power house 50x50 feet. The columns and beams are reinforced with three trussed rods, having centre section of 1x2 inches making total reinforcement 6 square inches. These trussed rods are a new design, introduced at Toronto, and are intended to get best possible results with greatest economy of metal. The beams are 20-ft. span, 16x24 inches area. The floor slabs are 16 ft. span, 7 inches thick reinforced with expanded metal, 3-in. mesh, 10 gauge, supplemented with ¾-in. round rods. The floors are intended to carry heavy loads, machinery, etc., with capacity of 300 lbs. per square foot safe load.

In Figure 5 is shown another modern idea in construction, being that of fire protection of light wells, as exemplified in Toronto building. In a great many buildings of wood interior construction the light wells and elevator or stairway openings are a costly hazard from an insurance point of view. By constructing a fireproof enclosure around such openings, owners of such buildings can get a considerable reduction in insurance rates. A great many of these enclosures have been protected by the use of expanded metal placed on channel furring and plastered on both sides to a thickness of 2 inches.

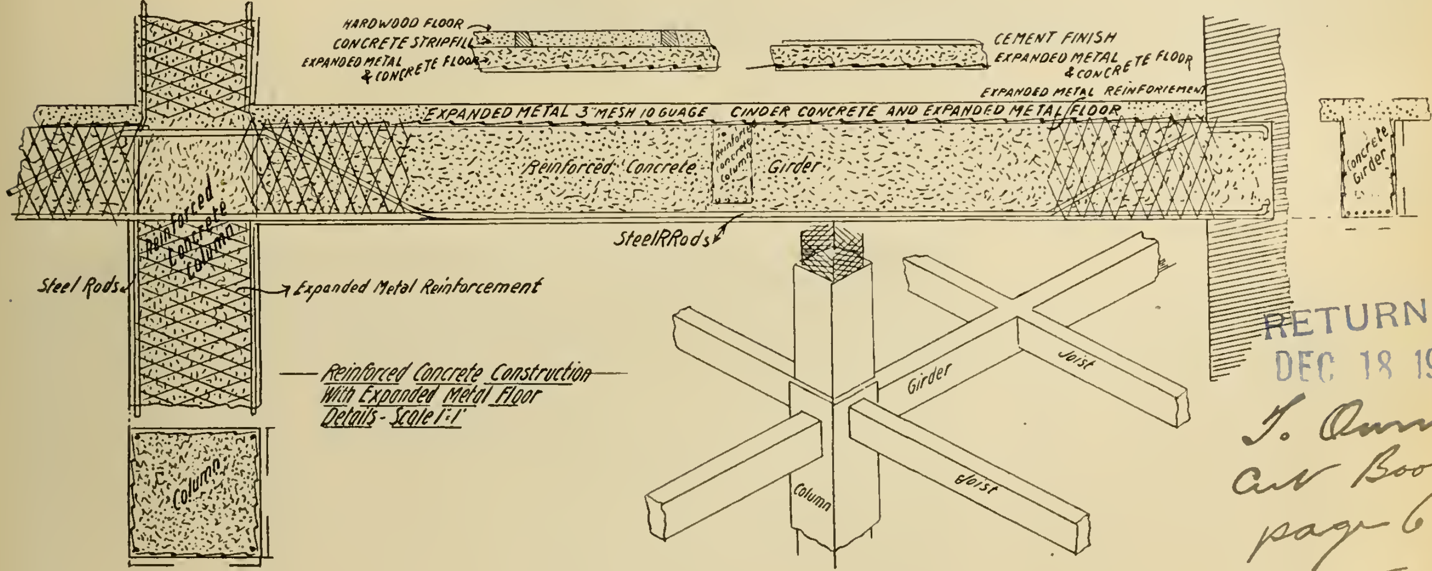


Fig. 1—Details of Concrete Work in Toronto.

A MODERN FACTORY PLANT.

AN example of rapid factory construction combined with modern methods and up-to-date equipment is being shown in the building of the new plant of the Simplex Railway Appliance Co., Montreal, at Blue Bonnets, situated on the Grand Trunk and Lachine canal, with sidings from

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C.P.R. and G.T.R., a few miles west of the metropolis. Work commenced on

Fig. 2—Showing the Centering in Place During the Progress of the Work.

the 15th of June and already the buildings are now completed with the expectation of commencing manufacture at once. The cost of construction will amount to $175,000. When the works are operating in full force over 200 men will be employed. The plant will be used for the manufacture of bolsters and brake beams, as is at present being done in the old premises of the company at St. Henry.

The main building is 387 feet long by 120 feet wide, made of brick 12 inch walls, steel frame, resting on concrete foundations, for which excavation was made to the bed rock. The windows extend from about four feet from the ground to the roof, giving ample light for manufacture. The roof is of fireproof construction, the trusses being placed 25 feet apart, the glass in the side walls of the centre roof being of rolled plate. The roof itself is made of 2 x 6 planks on edge, covered with Carey's exible magnesia ready roofing. The main building is divided into several shops. On the north side are the blacksmith shop, machine shop, and stores department. On the southwest corner is situated the shipping room and the paint shop, while along the south side are found boiler and plan room. The shop is to be electrically operated throughout with A. C. motors. Near by the main building is situated a transformer house.

Near the main building is situated the steel storage shed, 261 feet long by 60 feet wide. It is of different construction to the other, being spanned by wooden trusses, the roof and walls being of corrugated iron. The posts are set on square concrete cellars, 24 by 24 inches, the latter resting on the bed rock.

Nearby an artesian well over 500 feet in depth was sunk, but salt water was struck at this depth and the work abandoned. A curious coincidence in this connection exists, as a few miles distant the Canada Car Co. sunk a shaft for an artesian well with the same result.

Another large building of the plant is the castings shed, situated to the west and adjoining the main building, the walls and truss construction are similar to the steel castings shed, while the roof is the same as on the main building.

The office building, also in course of construction, is to be a handsome structure of brick, 64 x 40 feet, resting on concrete foundations. The first floor contains the general offices, the secretary's office, treasurer's office and vault. On the second floor the drawing office and blue print room are situated. The top floor contains a dining room and kitchen for the office staff. The building is heated by steam and lighted by electricity.

An air compressor is being installed to operate pneumatic tools, and blast for the forges. It is a Rand compressor with a capacity of 3,350 cubic feet of free air per minute, being run by a 200 horsepower Allis-Chalmers-Bullock motor. Other motors and electrical apparatus are be-

Fig. 3—Interior View of Finished Building.

ing suppiled by the Canadian General Electric. The Miller Heating Co., of Chicago, is installing the heating, being a vacuum system of direet radiation. All the heavy machine tools will eome from the works of John Bertram & Sons, Dundas. The power and lighting is contracted for from the Lachine plant of the Montreal Light, Heat & Power Co., a distance of three miles. The water to be used at the works will be obtained from a new system being operated by the Credit Municipal Canadian which has a franchise to furnish water from Lachine to Notre Dame de Grace.

Fig. 4—Interior Dunlop Tire Co. Factory.

IMPROVED FIRE PROTECTION.

A GREAT development has recently taken place in all kinds of equipment to prevent fires, but perhaps the most novel and certainly one of the most effective of these is the water curtain which has been more or less in use for about four years. The first attempts were necessarily crude, but now the experts think that they have the water curtain down to perfection.

The great Toronto fire a little over a year ago showed conclusively the great danger there is of buildings taking fire from those which are burning in the immediate vicinity. Especially in lanes and narrow streets, the air becomes superheated so that a vacuum is formed which will crash the window glass in adjoining structures unless it be kept cool. This may also be done by a stream of water from a hose striking the heated glass, which immediately breaks and creates a back draught, thus drawing in the fire. Almost all big fires in a crowded district spread in this manner.

The idea of a "water curtain" to protect against danger of this kind has grown so fast in the past three or four years that it is now reduced to a science, and only this week a Hardware and Metal representative witnessed the testing in Montreal of what is claimed to be the latest and most complete water curtain on the American continent. This curtain has been installed by the H. G. Vogel Co., whose Canadian office is on St. George street, Montreal, and it completely envelopes the great fur warehouse of L. Gnaedinger, Son & Co., on the corner of St. Peter and Recollet streets of the same city.

This particular curtain is in three sections, one of them covering the front of the building on St. Peter street, while the other two protect the Recollet street side. They can be operated singly and independently of each other. Each section is connected with the city water main by a large galvanized pipe, from which smaller pipes of the same material are projected along the tops of the windows, in the four upper storeys. It is claimed that in a high building like this the two lower storeys will require no further protection than is afforded by water dripping from the upper part of the building. At each window is a brass sprinkler head, which perforates the pipe and is so arranged that water spouting from the pipe strikes a concave surface which splashes the water over the whole window. It is obviously impossible for these windows to become heated, and they will consequently refuse to break and let in the back draught which draws the fire after it.

In the case of buildings with wooden cornices, another pipe is laid along the cornice, and sprinkler heads placed at intervals keep the cornice soaked during the progress of a fire in the vicinity. It is obvious that a building with metal roof and cornices, whose exposed sides are equipped with a water curtain, is outside. The force is supplied from the city water mains, but, should these give out, a steamer may be placed in commission and equally good results obtained.

In case of fire on the inside of the building automatic sprinkler systems have been introduced in many of the large warehouses and factories, so designed as to almost immediately extinguish fires which are the result of spontaneous combustion or other causes. A series of pipes, located on the ceiling, with sprinkler heads at intervals of eight feet or thereabouts, form the automatic sprinkler system. The sprinkler heads are plugged with a substance which melts at a relative low temperature, allowing the water to escape automatically and extinguish the fire. As the hottest part of any room is near the ceiling, no fire can get much headway before it is stopped by this ingenious device.

Among the Montreal business houses who have adopted the automatic sprinklers are S. S. Carsley Co., Henry Morgan & Co., W. R. Brock Co., Limited;

Fig. 5—Fire Protection for Light Wells.

C.P.R. Angus Shops; Canada Car Co.; Ogilvie Flour Mills; Thos. Robertson Co., Limited, and the Canada Paint Co.

The net result of the adoption of these precautions has been a reduction of between 50 and 75 per cent. in insurance rates.

LONGEST SINGLE SPAN GIRDER

A GREAT deal has been heard about the amount of work being done on the James Bay Railway, but few have realized that this great undertaking is fast approaching completion and will shortly land its cars at our very doors. In order to complete the roadbed many bridges are required. Herewith is shown one of the longest single span swing girders that has ever being placed across Janecks Narrows, Muskoka, and will weigh, when completed, upwards of 115 tons. Each girder is 140 feet long weighs 26 tons and requires five cars to transport it to Muskoka, from whence it will be floated into position. It is one of many built by the Canada Foundry Company, Limited, Toronto, at their Davenport works, for the James Bay Railway.

Longest Single Span Swing Girder in Canada.

BRICKLAYERS ALARMED.

THE use of concrete in building construction is growing so rapidly that bricklayers are taking alarm lest they lose their commanding position in the building trades. Several influences are co-operating to accelerate the growth of the use of concrete. On the one hand are the high cost of wood, brick, stone, and the skilled labor required to put these materials in place, while, on the other hand, are the cheapening of cement and increased familiarity with its adaptability in building construction. Some authorities go so far as to say that as concrete grows more familiar to architects and contractors the wooden house will disappear even from the countryside, wood being displaced by a material more durable, readily capable of artistic treatment, and much safer against fire from exterior causes.

THE WONDERS OF BUILDING.

THERE are no greater wonders of the age than are to be found in the building trades.

More wonderful things are being done with lumber to-day than were dreamed of a few years ago.

Greater wonders are being accomplished in the general construction of buildings. A few years ago all of the strength of the structure was in the outer walls, to-day the outer walls may be nothing but a coat for the inner structure, which will stand just as well without the wall as with it.

Greater wonders are being wrought in the designing and preparation of brick. Nothing in the way of color or originality of design seems to be beyond the possibility of the manufacturers.

Great wonders are being accomplished in interior construction, arrangement and decoration.

But probably the greatest wonder of the recent years in building is the rush to the fore that has been made by cement. It is but a few years, comparatively, when cement was very little used and very little understood. To-day whole buildings, from foundation to roof, every feature, with the exception of doors and window frames and glass, are being made of cement. To-day cement is mixed on the street and poured into moulds, which, when removed, leave the finished structure standing. Great bridges are being constructed in the same manner. Building blocks are being made, thousands to the minute, by ponderous machines, to take the place of stone. They are made in all sorts of shapes and designs.

Where cement was scarcely known a few years ago, it would now puzzle the builder to erect a structure without it.

The Dominion Coal Company may this Winter ship several cargoes of coal to Vera Cruz for consumption by the Mexican Heat & Power Company, in which James Ross and other Canadian capitalists are interested. A cargo sent last year to Vera Cruz is said to have been satisfactory to the Mexican enterprise.

Factory Heating

By S. R. Sheldon, Galt.*

AMONG the many marked improvements in manufacturing methods which have been called to the minds of the public, one of the most striking advances has been made in the heating and ventilation of factories, mills, and other large buildings. More attention is continually being devoted to obtaining the best means of maintaining a healthy atmosphere in the factory, and naturally the problem becomes more difficult in many instances, owing to overcrowding and the increase in vitiation due to the process of manufacture.

Evolution of Systems.

The old wood stove of our grandfathers was superseded by the hot air furnace, the furnace by direct radiation with either hot water or steam, and now direct radiation is discarded for a combined system of heating and ventilation obtained by a forced circulation of warm air. This system is what is known as the "Fan or Blower System," and comprises a fan, or blower, usually of the centrifugal type, a heater, and a system of distributing ducts or pipes more or less extended according to the conditions of each individual installation.

In ordinary practice the fan wheel is enclosed in a steel plate case, or "housing," as it is usually called, and is arranged to draw air through a steam heating coil constructed with closely spaced pipes. From the fan the air is discharged into the distributing ducts, which deliver the air to the desired points within the building.

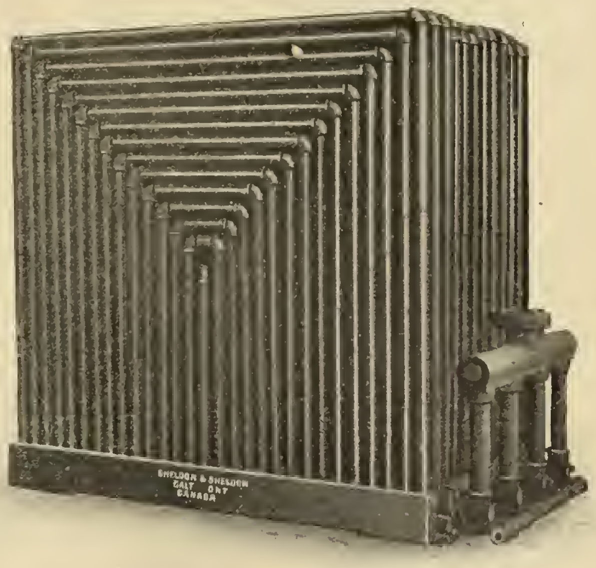

Fig. 2

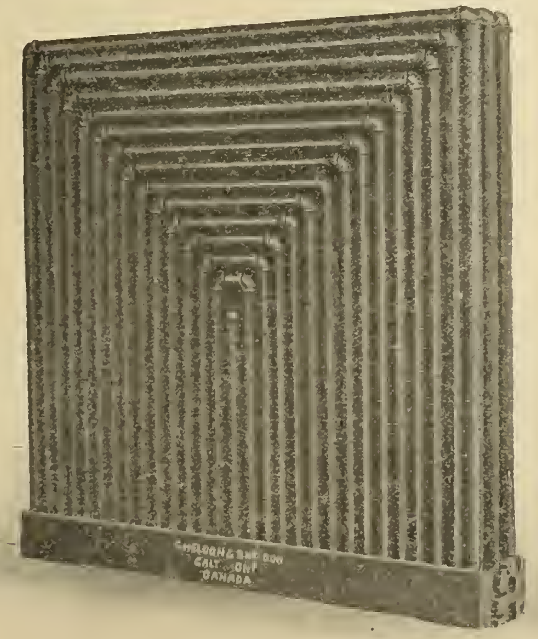

Fig. 1

When a building is heated by direct radiation with steam pipes strung along the walls, the wall itself close to the heating surface is maintained at a comparatively high temperature, so that the temperature difference between it and the external air is great, and a rapid loss of heat is the result. With the direct radiation suspended from the ceiling the loss is somewhat less, but still of considerable magnitude. With the low air velocities resulting from the natural circulation of the air across such direct heating surfaces, the hourly

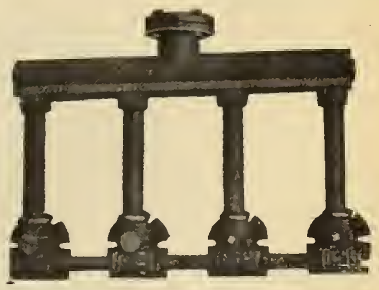

Fig. 3

condensation per square foot of surface with low pressure steam is only about .3 (3-10) of a pound of steam. As the velocity of the air across the heating surface increases, so does the rate of condensation of the steam and of the heat transmission. It is, therefore, evident that the heating surface required to transmit a given quantity of heat may be decreased in proportion as the velocity, and consequent volume, of

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* Member of the firm of Sheldon & Sheldon, manufacturers of heating, ventilating and drying appliances, Galt, Ontario.

air passing across the surface are increased.

Fan and Blower System.

In the hot blast system the heating surface is massed in one location, a decided contrast to the almost unlimited extent of pipe required for a system of

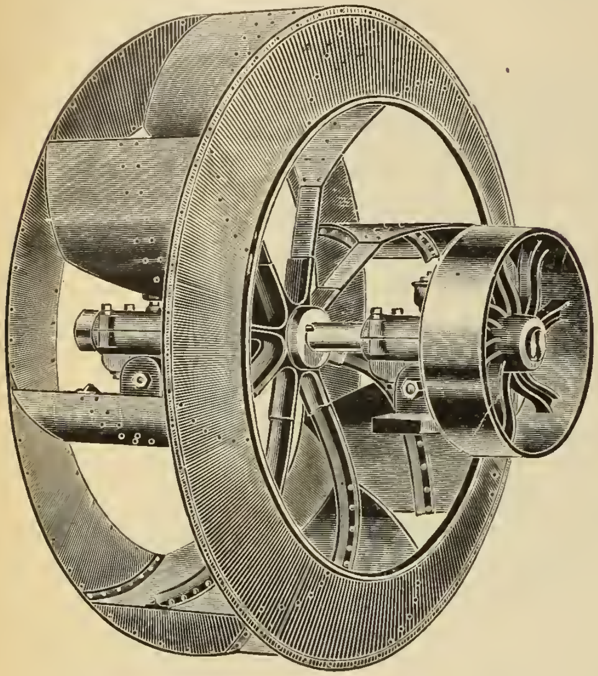


Fig. 4

Fig. 5

heating by direct radiation. This massed surface is usually made up in sections, each consisting of a cast iron base with suitable partitions or diaphragms, so arranged that the steam, admitted at one end, passes up, over, and down a series of steam pipes (as shown in Fig. 1), and finally escapes in the form of water of condensation from an outlet immediately below the point

Fig. 6

where the steam enters. These sections are put together in groups (Fig. 2) and the inlets and drips of several sections are connected together by means of cast iron headers (Fig. 3), the heating effect with constant air velocity being proportionate to the depth of the heater. The more rows of pipe across which the air must pass, the higher is the resultant temperature. This massing together of the heating surface eliminates the constant danger of the pipes freezing and of damage from leakage as well as from fire where high pressure steam without proper insulation is employed. Insurance rates may thus be reduced and convenience secured in the control of the temperature throughout the building.

The design of the fan must depend largely upon the conditions of each installation. As usually constructed, it can be arranged to discharge in any given direction, and may be built either with a full casing or with a portion of the scroll formed in the brick foundation. This latter is known as the three-quarter housing type. The fan wheel is constructed as shown in Fig. 4. The hub of the wheel is of cast iron, cast around steel tee arms, to which are firmly rivetted the blades, to the edges of the blades are rivetted the side plates which stiffen the construction of the wheel. The shaft is of steel, carefully turned and polished, and the bearings are of the self-oiling, self-aligning type, capable of running an almost indefinite time without attention.

In Fig. 5 is illustrated a full housed steel plate fan, up discharge, as used for this system of heating, and in Fig. 6 is shown a three-quarter housing fan with direct connected engine, the inlet of fan being connected to the heater. This engine-driven fan makes the most convenient arrangement, as the heating system is thus rendered entirely independent of any other source of power and may be started up at any time.

Fig. 7

This is particularly desirable in the matter of heating up in the morning, or for continuous operation during the night.

From the fan outlet the air is conducted by galvanized iron pipes or underground brick ducts to its proper destination. In the ordinary type of factory heating, such as a foundry,

boiler shop, or machine shop, the usual and most efficient arrangement is secured by extending the galvanized iron pipes overhead and almost entirely round the interior of the building, outlets being provided at regular intervals so that the air is discharged outward toward the walls and slightly downward. A barrier of warm air is thus maintained along the outer walls of the buildings, which prevents any bad effects from the cold walls, and provides ample circulation and ventilation. The usual inward leakage of cold air through cracks and crevices is prevented by the fan keeping a constant pressure in the building. All the outlets from the galvanized iron or underground hot air ducts should be arranged with dampers or blast gates (Fig. 7) so that any or all of them can be shut off at will.

The ordinary type of heater uses exhaust steam, but it can be so arranged that if necessary in very cold weather additional heating power may be secured by admitting comparatively high-pressure steam to one or more sections across which the air of highest temperature passes. This can be arranged by inserting valves in the connections shown in Fig. 3.

The actual cost of operation of an engine-driven fan is very slight, for the exhaust steam can be utilized in the heater, the steam by passing through the engine only losing about 10 per cent. or 15 per cent. of its heat efficiency.

In the ordinary hot blast piping system allowance must be made at all turns and branches for the resistance these offer to the air. As a rule the total area of the outlets should range from 25 per rent. to 40 per cent. in excess of the area of the outlet of the fan. The entire air supply can be taken from outside, or during the coldest weather, the air may be returned from the building itself in any desired proportion, and can, in this way, be continuously re-heated.

In ordinary factory heating a complete change of air every 15 or 20 minutes would be ample, but for schools, hospitals, etc., the air should be changed much more frequently, usually in from 8 to 12 minutes, but in this class of building the air supply is calculated from the number of occupants in the rooms.

Where Applied.

The blast system of heating has been applied successfully to schools, colleges, audience halls, textile mills, paper mills, machine shops, foundries, car sheds, and roundhouses. In paper mills and dye houses there is an excess of moisture which renders the atmosphere foggy and unbearable; by introducing this system large volumes of warm air discharged into the rooms will absorb the moisture and prevent the deposition of the moisture on the ceiling, and the consequent dripping which is annoying and causes, in many cases, considerable damage. In the foundry equipped with the fan or blast system, large volumes of air at moderate temperatures can be forced in while the iron is being run off, thereby clearing the atmosphere and rendering it more healthful and comfortable for the men. In other classes of buildings where more or less objectionable odors, vapors or gases, result from the process of manufacture, the admission of large volumes of air tends to materially reduce the inconvenience and possible danger. Numerous adaptations occur where the convenience of the massed heating surface or the effects of perfect ventilation have a considerable commercial value. Of course the individual conditions must control the method of application and installation, and for this reason each plant has to be carefully checked over, and the heating system should be designed by a competent engineer or manufacturer of these articles.

BOOK REVIEWS.

Principles of Electric Power for Mechanical Engineers, by A. B. Bate, Associate Member Institution of Electrical Engineers, New York, Spon & Chamberlain, 123 Liberty street, 204 pages, well illustrated, price, $2.

A perusal of this book reveals the fact that it is intended for those interested in electricity and brought in contact with its practice, who are not conversant with the theory of direct current electricity or with its application. Another reason for the appearance of this volume is the fact that such rapid strides have been made in the application of the electric motor in different industries that it has become a necessity for everyone to know something of electricity and modern electric machinery. A commentable feature of this book is the fact that it seeks to explain by description rather than leading the reader through a maze of mathematics. The fundemental principles underlying the running of a motor are dealt with, and from that the reader is taken to its application under different conditions. It is just such a book as this that those desirous of obtaining a grasp of the subject of electricity and its more recent application will obtain and read thoroughly. While in covering only the direct current part of the field it merely enters upon the broad subject, nevertheless it has a claim upon many who wish to take up the subject without going into it to any great extent.

* * *

Pocket Diary. A pocket diary and year book for 1906, published by Emmot & Co., Limited, Mechanical World, Manchester, Eng. Price, 6d.

This hand-book is very complete along the lines of steam, steam engines, including the turbine, steam boilers, beams and girders, gas engines, and also contains very many formulae on electrical transmission and application of power, transmission devices and other things of a like nature. The various tables at the end of the book should prove very useful and the very complete index is an excellent feature. The hand-book is completed by the 1906 diary.

* * *

Mechanical Appliances and Novelties of Construction, by Gardner D. Hiscox, M. E., being a complete work and a continuation as a second volume of the author's book, Mechanical Movements, Powers and Devices. Contains 1,000 especially made illustrations. 400 pages; price, $3.00. New York. Norman W. Henley Publishing Co.

When the author's first volume was published dealing with the subject of mechanical devices, it immediately sprung into universal favor, and the ten editions through which it went tell of the standing attained by it. Realizing that the field was not fully covered in this volume the author undertook the publication of a second and its appearance and contents show that he has covered the subject in the same comprehensive manner as in volume one. It is arranged in twenty-three sections, commencing with mechanical power and covering the subject of power appliances and devices through the fields of steam, hydraulics, gas and electricity. This is followed by special devices of great industrial importance. The book ends with about 55 illustrations and descriptions of the various types of perpetual motion machines that have been before the public during the past three centuries. This book should meet with the same favorable reception accorded Mechanical Movements, Powers and Devices, as the quality and scope of the contents fully warrant it.

Power and Transmission

Steam Gas Electricity Compressed Air Water

RONAN GAS ENGINE.

IN the last number mention was made of a somewhat remarkable gas engine invented by A. G. Ronan, of Toronto, and of which further particulars are given herewith. In the drawings shown Figure 1 is a vertical central section through the preferred form of explosion chamber constructed according to the invention and showing the same attached to the engine casing provided with power transmitting parts. Figure 2 is an enlarged detail view of the mechanism for operating the valve. Figure 3 is a side view of a portion of the explosion chamber showing the form of main exhaust-port used in this cylinder. Figure 4, the vertical central section through an alternative form of explosion chamber. Figure 5 is a vertical central section through another alternative form of explosion chamber. This figure also shows a longitudinal section through the measuring device used and tank for same. Figure 6 is an enlarged view of the mechanism for operating the valve in the explosion chambers shown in Figure 5.

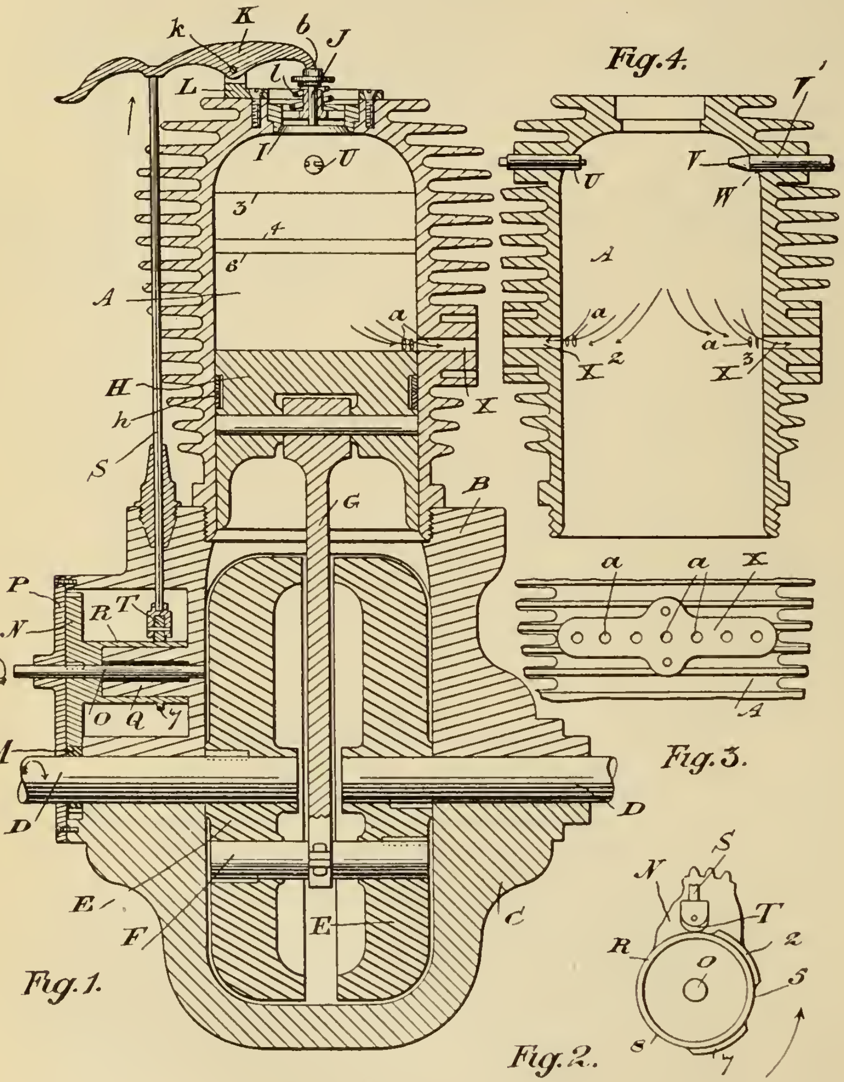


Fig. 1—Ronan Gas Engine—Sectional Views.

The particular claims of this invention are the combination with an explosion chamber provided with an opening through which fuel only is fed and a main exhaust port opened and closed by the piston head ; the piston head itself ; means for feeding raw liquid fuel into the explosion chamber through fuel opening and a valve controlling a port from the explosion chamber to the atmosphere ; of means whereby the valve is opened to permit the piston head to remove waste products of combustion from explosion chamber during one of its inward movements and kept open while the piston head is moved a certain distance outward so as to admit fresh air into the explosion chamber, together with the cycle of operations necessary in the gas engine and in the accomplishment of this getting rid of the residue of the waste products of combustion.

In looking at the drawings it is supposed that an explosion has already taken place and forced the piston head H already down into the position shown in Figure 1. As the piston head opens the main exhaust port X waste products of combustion exhaust through the several holes O of same, and by the time the piston head moves upward and closes said main exhaust port the major portion of the waste products of combustion have passed from the explosion chamber. Simultaneously the piston head H closes the main exhaust port X, the valve J is opened by reason of the cam 2, secured to or forming part of the sleeve R, abutting the roller T, thus moving the rod S upward in the direction indicated by arrow and depressing the end b of the lever K. The valve is kept open while the piston head H moves to the limit 3 of its inward stroke, thus discharging a second volume of the waste products of combustion through the valve. The said valve still remains open during the movement of the piston head H from line 3 to approximately line 4, thus permitting a charge of pure air to rush into the explosion chamber on top of the residue of the waste products of combustion therein, thus keeping same next the piston head. Immediately the cam 2 escapes the roller T the said roller drops onto the uniform periphery of the sleeve R and rests in contact with same for the space 5 shown between the cam 2 and the other cam, thus permitting the said valve to be closed by its spring 1. The length of the space 5 is approximately indicated by the distance between the lines 4 and 6. During the length of this space the required charge of raw liquid

fuel is discharged through the delivery end of the conduit to the fuel-measuring device into the explosion chamber into the body of pure air above the residue of the waste products of combustion. Immediately the cam 7, secured to or forming part of the sleeve 4, abuts the roller T, the rod S is moved upward, depressing the lever K, so that the valve J is opened, and as the piston head continues in its outward movement a volume of fresh air simultaneously rushes into the explosion chamber. From the time the piston head again opens the main exhaust port X and until it closes same on its return movement the residue of the waste products of combustion are removed from the explosion chamber. Simultaneously the piston head H closes the main exhaust port X, the roller T escapes the cam 7 and rests again upon the periphery of the sleeve R_1 for the space 8 between the cams 2 and 7, thus closing the valve. During the continued movement of the piston head the explosive mixture is compressed, ignited and exploded, and the piston head H forced down into the position shown in Figure 1, when the above-described cycle takes place again. By opening the valve J by the cam 7, thus permitting pure air to rush into the explosion chamber from the atmosphere, it will be seen that the proper proportion of air to be mixed with the raw gasoline in order to provide an explosive mixture is assured.

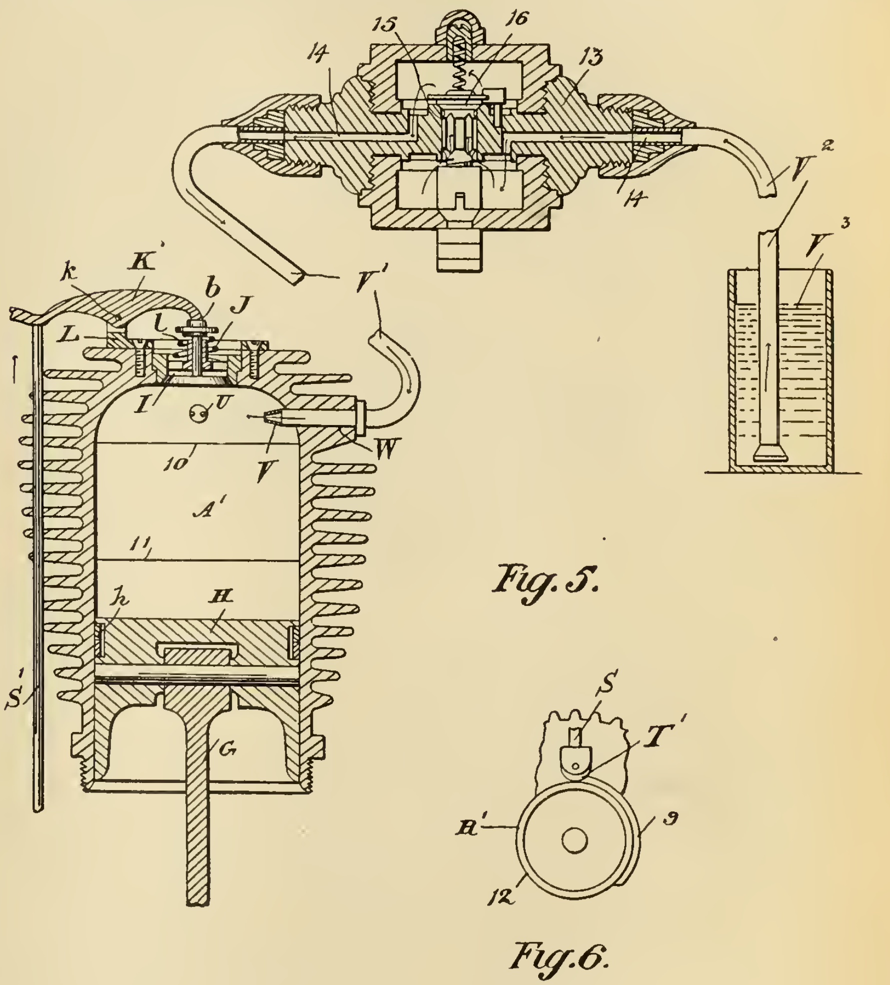


Fig. 2—Ronan Gas Engine—Details of Feed.

ROTARY ENGINE INVENTED AT GALT.

RUMORS of an important invention in the field of prime movers have been coming from Galt recently to the effect that Mr. Chas. Heatherington had designed a radical departure in the shape of a rotary engine that possessed remarkable features. In order to verify this a representative of Canadian Machinery called at the R. McDougall works, where the engine had been built, and found that no misrepresentation had taken place.

The engine of which so much is expected is called the Daily Rotary and is the invention of Mr. Chas. Heatherington, of Galt, who has been assisted in his work by Mr. R. W. Roelofson, mechanical superintendent of the R. McDougall plant.

It is an extremely simple affair, having very few working parts and occupies but small space. The one built, on which a load of over four electrical horse power in lamps was placed with no diminution of speed, occupies a floor space of 8 by 12 inches, stands 16 inches high and weighs but 150 pounds.

Its greatest feature commercially is the extreme cheapness with which it can be made. Two shafts and two gears are the only steel parts in it, all others being cast iron. It consists of three main parts, an assembled rotor, and two abutments. The rotor itself to which the pistons are attached is the fly wheel, steam chest and cut-off combined. The abutment revolves, which automatically opens, passing the piston through and closing, the principle being the same as if the piston were the tooth of a gear and the abutment an intermittent gear. The rotor is hollow, forming a steam chest which is continually kept at boiler pressure by means of steam ports. When the piston reaches the position where steam should be taken, a port from the wheel coincides with a port leading to the piston by means of which the steam is admitted against the piston, and is designed to remain open during the desired portion of the stroke.

While all the moving parts are rotary the principle is not that of the turbine as it has a positive piston action, cutting off at any part of the stroke and taking as efficient an expansion as an ordinary reciprocating engine. The reason claimed by the inventor for sticking so closely to the pure rotary motion principle is that the piston area is reduced and the piston speed increased; that is, a certain number of revolutions per minute must be made to possibly consume as much steam as the slow-running reciprocating type.

Another feature is the fact that the engine will run at very low pressure, a pressure of 5 pounds running the engine with no load at a speed of 960 revolutions per minute.

Experiments made with variable cut-off showed that the engine would work from as low as one-tenth to as high as one-half stroke.

A company has been incorporated, capitalized at $100,000. It is not intended that the firm should manufacture this engine but to give it out for manufacture on a royalty basis. Any further information regarding this engine may be had from the gentlemen whose names are given above.

ON LIVING.

We live in deeds, not years; in thoughts, not breaths;
In feelings, not in figures on a dial.
We should count time by heart-throbs. He most lives
Who thinks most, feels the noblest, acts the best.

—Philip James Bailey.

A WESTERN INSTALLATION.

WHAT is probably the largest installation of a suction gas producer power plant in Western Canada has recently been completed by the Cooper Gasoline Engine Co., of Winnipeg, Man., for the Alexander Milling Co., of Brandon. The plant consists of a 250 H.P. three-cylinder vertical Weber gas engine and a producer plant designed especially to work on the native lignite coal, which is found in the south-eastern portion of the Province of Saskatchewan. This is commonly called Souris coal throughout Western Canada.

The plant was sold under a guarantee of a fuel consumption not to exceed 3 1-2 pounds per B.H.P. per hour, and on tests which have been made it has reached an actual working consumption of 2 pounds per H. P. per hour. A car of semi-anthracite coal from the Bankhead mine near Banff, Alberta, has been tried and found to give most excellent results. On a twelve hour test it produced power on a consumption of slightly less than one pound per H. P. per hour. Souris coal, or lignite, can be delivered in Brandon for $3.00 per ton, while the semi-anthracite costs $6.00, so that the actual cost of fuel for each class of coal is about the same.

There is some advantage, however, in the use of the semi-anthracite as there is, of course, only half the labor attached to the handling of it. There is also a slight advantage in the fact that it does not require as much water to be put through the scrubber to clean the gas.

This is probably the largest flour mill in America being run with power of this description, and the performances of the plant have, so far, been quite satisfactory to the purchasers.

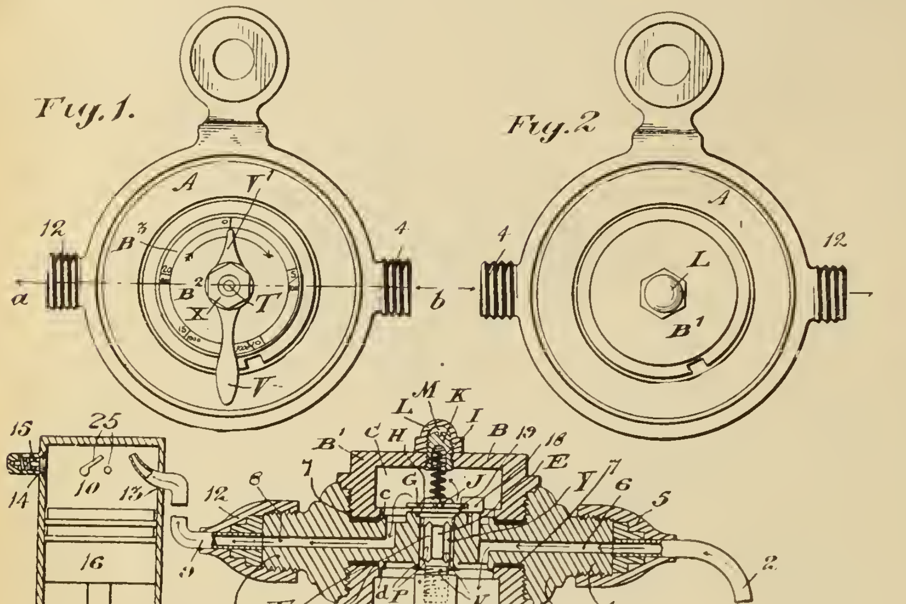


Fig. 3 Ronan Gas Engine The Petrol-Meter.

COMBINED STEERING AND PROPELLING APPARATUS.

AN apparatus which is designed to steer and propel a steamer without the use of a rudder, and to reverse or check its speed without stopping the engines, has been invented and patented in Canada, United States and Great Britain, by S. W. Jennings, electrical contractor, 4 St. Antoine street, Montreal.

Expressed briefly, the principle is that of a pair of screws, one immediately behind the other, which revolve in opposite directions, but with the blades so arranged as to exert a propelling force in the same direction. These screws also furnish the means of steering, by being turned in an orbital motion, which thrusts the stern of the boat in whatever direction required.

This new invention is applicable to any style of engine, whether gas, triple expansion, or turbine. Indeed, as will be seen, the ideal system would be a vertical turbine engine situated right above the propellers, thereby making a direct drive.

The drawings, however, show the application of a regular horizontal shaft drive. A hollow vertical shaft enters the stern above the water line and encloses a solid shaft which is connected with the steering gear. This solid shaft is held in position by supports from the hull, as is seen in the drawings, and close to the bottom a cross shaft is fixed, on which the screws revolve. The screws, which should run on roller bearings, are connected by bevel gears with the upright shaft, which, in turn, is driven by the horizontal shaft in the same manner. These two shafts are quite independent of each other in action, and friction between them is reduced as much as possible by ball bearings where they come into contact.

The solid upright shaft is connected with the pilot house in much the same way as the rudder, in the present system, an arrow on the indicator showing the exact direction in which the shaft is turned, and, therefore, the direction in which the boat is being steered. Whenever this shaft is turned, the screws are also turned in an orbital motion, thus driving the stern in this way or that, and changing the direction in which the ship is going. When it is found necessary to reverse, the shaft is simply turned half way around, without stopping the engines, and, as the blades will then be pulling the boat

backward, the reverse motion will be accomplished almost immediately. If a sharp turn is wanted, the crank is turned about one-quarter around, with the result that an active force drives the stern around without propelling the boat forward. As this is far more effective than the mere dragging action of a rudder, it is claimed that a ship can be turned completely around in her own length. If it is desired to check the speed of the boat without stopping the engines, all that is required is to let go the steering wheel, thereby causing the engine to drive the propellers orbitically.

An important point in connection with this new invention is the fact that, by its adoption, bilge water will be practically a negligible quantity. The entrance of the main shaft is above the water line, and a tube screwed into the boat there runs up to the crown, which is even with the load line. Thus, a boat will have to be loaded up to above the load line before any water will be admitted into the hold, and even then the pressure will only be in proportion to the depth of the water above that.

Among the advantages claimed for this apparatus may be mentioned the obvious fact that it gives the power of two propellers with the draught of one. It will be inexpensive, the additional cost for a 30-foot boat being only about $50. The engines need not be stopped for the reverse or any other action, while the momentum may also be stopped without interfering with the engines.

Finally, the rudder is done away with, and the boat can be turned in its own length without any careening action. This latter claim has been substantiated by the tests Mr. Jennings has made with his small model, which was made without a keel and with a round bottom, so as to invite a careening action, if such were possible.

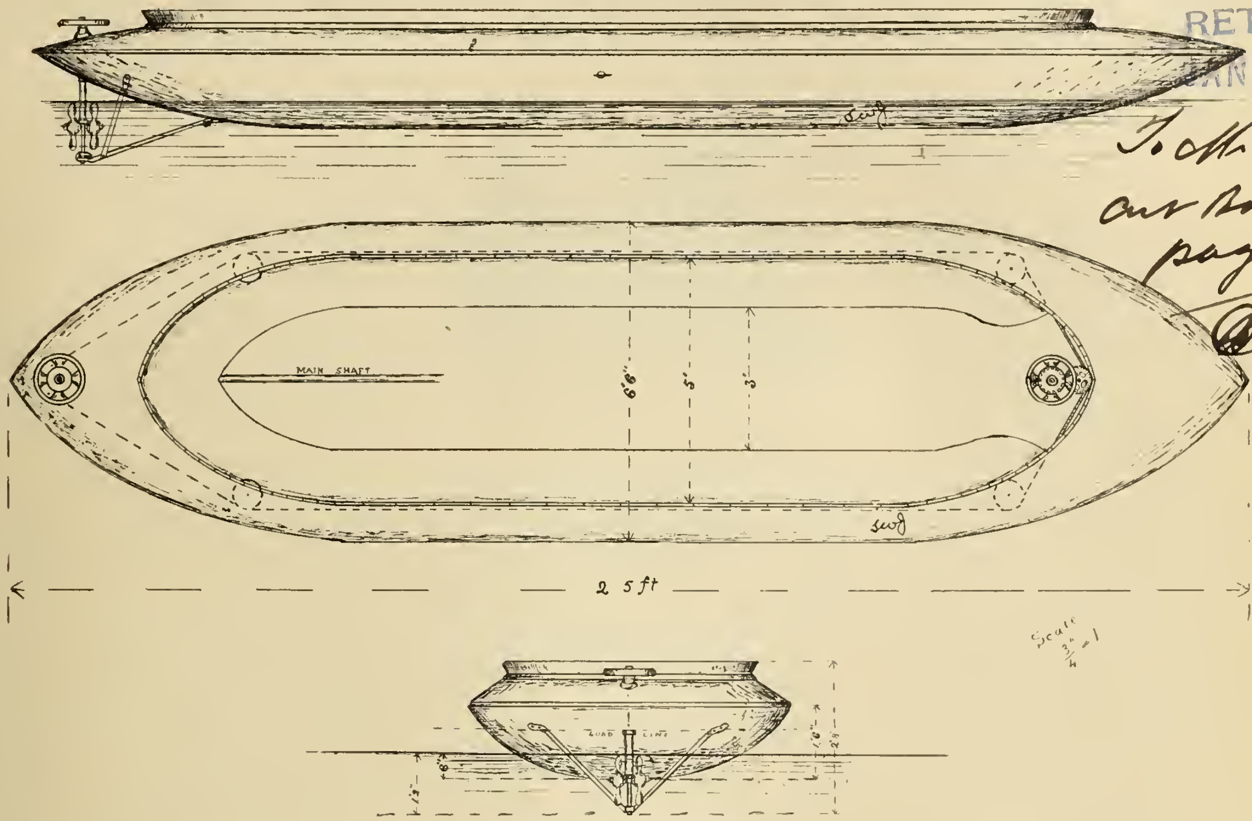


Fig. 1—Combined Steering and Propelling Apparatus.

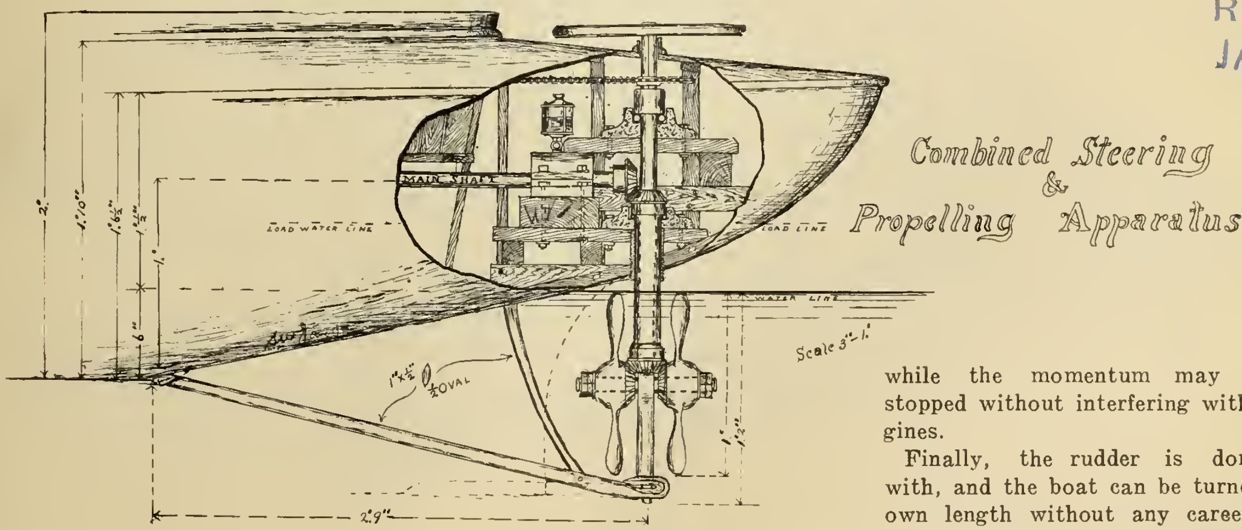


Fig. 2

It is understood that a company is about to be formed for the manufacture of this apparatus, and much interest will be taken in its outcome.

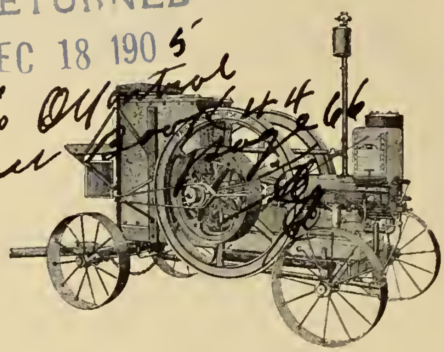
By placing this apparatus, fore and aft horizontally, in a submarine boat, it will drive the same down or up, as well as being the principal power for a forward or backward motion of the boat, (according to the wish of the pilot), and in this way do away with the necessity of taking in water ballast when desiring to descend below the surface.

PORTABLE GASOLINE ENGINE.

No doubt many readers will be interested in the accompanying cut of Fairbanks-Morse portable gasoline engine, which represents the very latest achievement in this line. This portable engine has been specially designed and constructed to meet the various uses and conditions under which such an equipment would be operated.

Appreciating that an outfit of this kind must be subject to rough roads and hard usage, the makers have provided for such contingencies and present this engine as the most perfect and complete equipment that has been placed upon the market. This gasoline engine possesses many advantages over the portable steam engine, as it requires no engineer, and no coal, wood or water, as in the case with the steam outfit. It can be started at a moment's notice in all kinds of weather, and there are no leaky flues nor danger from fire. It is specially adapted for threshing, shredding, pumping, grinding feed, sawing wood, shelling corn, etc., and excels all other power for general farm purposes, being always ready, reliable and simple to operate. This engine is supplied with the F.M. patent self-starter. The engine also has a special water-cooling tank.

If any readers are interested in this more particulars will be furnished by the Canadian Fairbanks Co., Limited, Montreal and Toronto, who are the sole Canadian agents for same.

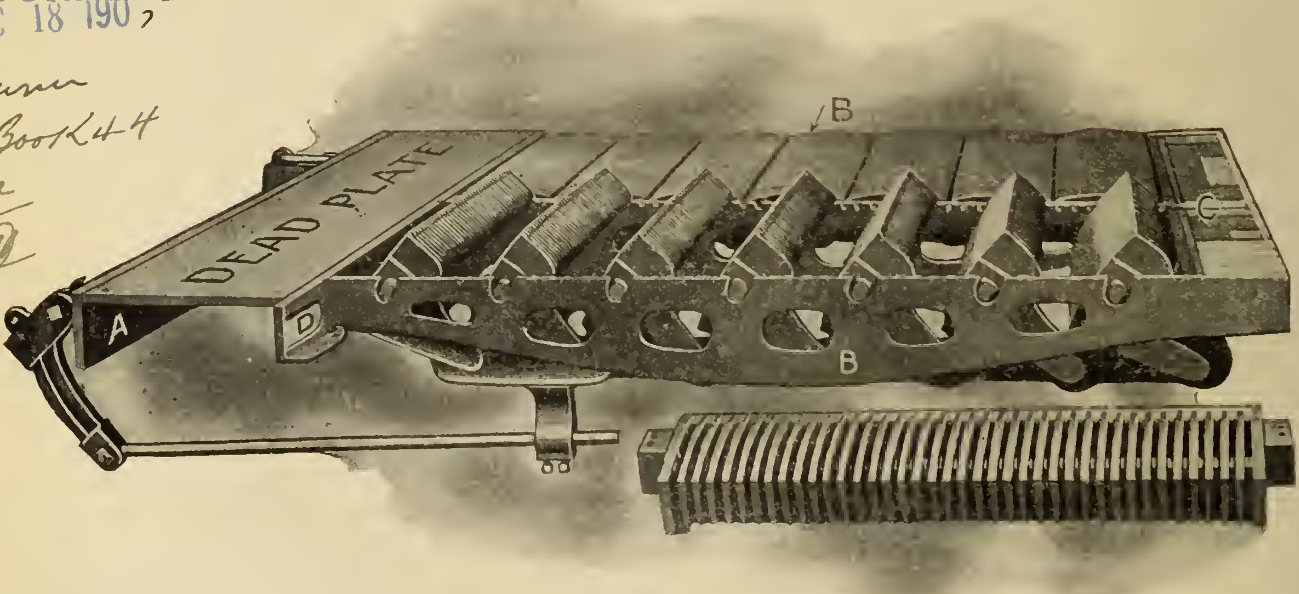


Portable Gasoline Engine.

CYCLONE SHAKING GRATE BAR.

Visitors at the Toronto Industrial Exhibition on passing through the Machinery Hall were attracted by a novel grate bar, the operation of which was shown and of which an illustration is herewith presented. It is being manufactured by P. E. Durst, Toronto, Canada, and several important claims are held for this style of grate bar. Amongst these are its simplicity, durability and economy of fuel. It has no rockers and no complicated parts underneath the bar to get out of order or obstruct the draft. The rolling and lifting movement when shaken keeps the air space open and causes no friction on the draft passing through the bar. It has 90 per cent. under draft. The frame locks together without bolts and is easily placed under the boiler and will not lock but bind in twain but always shakes freely. It has the same space in the ash pit as has the ordinary bar. No part of it is in the way to prevent the fireman from cleaning out the ashes, which makes it particularly applicable to internal fire boilers. The air passes through and over the top of frame, thus the frame is kept cool and cannot warp. All parts of the bar and frame are trussed and bridged. In addition it is level at all times when locked so that no bars stick up in the fire to burn off. It is further claimed for this grate bar that it will evaporate more water per pound of coal than any other device. A large number of these have been installed, and from testimonials received it appears that they are giving splendid satisfaction.

The Dominion Iron & Steel Company has just received a contract from the Boston Elevated Railway for a sample shipment of rails to be used on the curves of that line. The maximum wear of the ordinary steel rail on the curves of the "L" road is forty-three days, but it is confidently expected that owing to its exceptional wearing quality the Sydney rail will show, as a result of the experiment, an advantage of at least fifty per cent. over the material hitherto used.



Cyclone Improved Grate.

Practical Questions and Answers

Insulation Resistance.

Ques.—What is a convenient method of determining the insulation resistance between the field or armature coils and the frame of an electric motor ?

Ans.—This is determined in a simple way, as follows :

The motor is disconnected from all outside circuits. A line of, say, 250 or 300 voltage should be obtained, and tapped with two wires, one on each side of the line. The exact line voltage should be determined by means of a volts meter. Then the required resistance should be connected up in series with the voltmeter, which will serve as an ammeter. For instance, if the insulation resistance between the series coils and the frame is to be tested, one end of line should be connected to the series field terminal, while the other should make connection with the frame of the machine, a convenient place being the commutator shaft, the wire being held against the shaft so as to form a good connection. Thus, the current flows into the coils, across the insulation to the frame, and thence through the meter back to the line. The current leakage can be measured by the voltmeter, and the insulation resistance can from that be obtained thus :

Et Æ= service main volts, as determined
e = voltmeter reading when in service with the insulation,
v = voltmeter resistance,
I = leakage of current causing deflection "e" in voltmeter.

This from Ohen's Law :

$$E=T(R+v)=\frac{e}{v}(R+v)$$

$$\therefore R=\frac{E(}{e}-1)v$$

Thus the required resistance is determined. In conducting this test it should be seen that the armature coils are thrown out.

In the same way the insulation resistance of the shunt-field coils, of the armature coils, of the series-field coils and the armature coils together, of the armature and shunt-field coils in parallel, etc., can be found.

In conducting these experiments a voltmeter of less capacity than the line voltage should never be used, because of the possibility of a short circuit.

In a test on a 5.62 k.w. motor, 125 volts, 1,400 r.p.m., Westinghouse motor, the writer obtained the following results, which may be of interest :

(Shunt field and armature, R = 141861.18 ohms ; armature coils alone R=162168 ohms ; the series and shunt fields and the armature, R = 137509.74 ohms.)

* * *

Meaning of Heat Unit Terms.

Ques.—In the measurement of heat units there are the two terms, the British thermal unit, and the calorie ; what is the meaning of each ?

Ans.—The difference between the British thermal unit and calorie, is that the B.T.U. is the unit of measurement in pounds and degrees Fahrenheit, while the caloric is the unit of measurement in grains and degrees centigrade. A British thermal unit is the amount of heat required to raise the temperature of one pound of water one degree F., at or near the temperature of 39.1 degrees F. There are two calories, the great and the small, but the calorie ordinarily spoken of is the amount of heat required to raise the temperature of one kilogram of water one degree C., at or near the temperature of 4 degrees C. The relation existing between the two units is as follows :

1 B.T.U. = 0.252 calories
1 calorie = 3.968 B.T.U.

* * *

Engine Horse-Power.

Ques.—What is the rule to find the horse-power of a simple non-condensing engine ?

Ans.—A simple rule which may be relied on for approximate results is as follows : Multiply the net area of the piston in square inches by the mean effective pressure in pounds per square inch, and by the velocity of the piston in feet per minute. This will give the power in foot-pounds per minute. This, divided by 33,000, will give the gross horse-power.

The friction of the engine would amount to from 10 to 25 per cent of this, depending upon the efficiency of the engine. Thus the net horse-power will be from 10 to 25 per cent. less than the gross horse-power.

For accurate results a brake test of the engine should be made.

* * *

Electrical Machinery Heating.

Ques.—How can it be judged whether an electric motor or generator is being heated to a dangerous degree ?

Ans.—For accurate testing it is necessary to use a thermometer, the bulb of which should be covered with waste to keep in the heat. If working properly the temperature of no part of the machine should be more than 45 degrees C., or 81 degrees Fahr., above the temperature of the surrounding atmosphere. A rise of the temperature much above this indicates that there is a fault somewhere. If the temperature rises to the vicinity of 100 degrees C., or 212 degrees Fahr., the machine should at once be shut down. The simplest way to locate the source of heat is to start the machine cold and running it fast for from 3 to 5 minutes, then test the temperature of the different parts likely to heat, before the heat has time to equalize throughout the machine.

A simpler, but of course less accurate, way is to test the heat by the hand. If the heat is bearable for a few moments the machine is running well, but if not it is time to look for the trouble. This way is, of course, not a good one, in that some hands can stand much more heat than others.

If a smoke or odor arises from the machine it is a very sure indication of overheating, and, of course, the machine should be stopped at once and examined for the cause of the heating.

* * *

Keeping Direct Connected Motors Clean.

Ques. On page 355 of your September issue you publish a photograph showing an electric motor directly connected to a double-head lathe. Would you please inform me how such a motor is kept clean. Does it not draw to it the small cuttings from the machine.

Ans. Regarding the question of keeping the machine clean a motor in this position is as easily kept clean as any other; in fact more so than a great many on account of the accessibility. The best way to keep such a motor free from dust is by constant use of a pair of hand bellows supplemented by ordinary dusting of the outside parts and burnishing the commutator with canvas to which has been added a little vaseline. As far as attracting the cuttings is concerned there is no trouble from this source whatever. In the direct connected motors used the magnetic circuit is complete within the machine, there being, comparatively speaking, no free field whatever whereby metallic particles will be attracted to the machine.

The Waterous Co., Brantford, are building an $8,000 addition to their factory.

ABOUT CATALOGUES

By mentioning Canadian Machinery, to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Air Power. The 4th number of Air Power, dated October 1st, issued by the Rand Drill Co., has been received. This quarterly contains much that is interesting and useful to those interested in air power. It is announced in this number that the publishers have decided to discontinue this publication.

Westinghouse Storage Batteries. What is probably the first literature by them on this subject has just been issued by the Westinghouse Co., and serves as an announcement of a new and important branch of their business. On entering this field the Westinghouse Co. are following out their former aggressive policy and it may be taken for granted that the quality of these batteries will be maintained at a high standard. Size 4¼ by 5½.

Stone Working Tools. A fifteen page booklet issued by the Ingersoll-Sergeant Drill Co., New York, showing the uses to which pneumatic tools are adapted in connection with tracing stone for structural work. Size 6 by 9.

Geared Solid Die Stocks. The Borden Co., of Toronto, have just issued a catalogue in which are well illustrated with half tone views the die stocks manufactured by them. Anyone interested in threading machinery should see this catalogue. Size 5 by 7.

The Fairbanks Standard.. The first of a monthly publication from the advertising and publishing department of the Canadian Fairbanks Co. has been sent out. It contains a great deal regarding the equipment and installations of the Fairbanks Co., as well as other useful and general matter. It is a very creditable publication for the first issue and is certain to be well received by the trade. Size 6 by 9.

Air Cooled Electric Drills. Special circular, No. 52, issued by the Chicago Pneumatic Tool Co., Boston, describes their Air Cooled Duntley Electric Drills, besides a number of illustrations of these drills. Two pages are devoted to results of testing made at the Cleveland factory, showing the capabilities of this line of drills. Size 6 by 9.

Cincinnati Shapers. A 47-page catalogue describing the many makes of shapers made by the Cincinnati Shaper Co., Cincinnati, Ohio. Each design is illustrated, opposite to which specifications of the different machines are given. Some of these machines are of very recent design. Anyone interested in shapers should have a copy of this. Size 6 by 9.

Taper Roller Bearings. A small booklet illustrating the lines of Taper Roller Bearings manufactured by Canada Bearings, Limited, Hamilton, Ont. Size 3¼ by 5⅞.

Sterling Goods. A description of hack saw blades and power machines manufactured by the Times Saw & Stamping Works, Buffalo, N.Y. A neat catalogue of 16 pages, illustrating and describing these lines and giving the capacities of each. Size of catalogue 5¼ by 7¾.

Gear List. A 117-page catalogue issued by the Holyoke Machine Co., Holyoke, Mass., containing their bevel gear list, as well as lists of mitre gears, angle gears, spur gears, worm gears and worms, racks and pinions, besides balance wheels and hand wheels. Rules for computing gear ratios are also given. Description of bevel gears occupies 51 pages and includes a wide range. Information contained in this booklet is of value and the book is worth keeping for reference. Size 5¼ by 6.

Lubricating Specialties. This is a paper covered catalogue illustrating and describing the different specialties for engine and machinery manufactured by the Lunkenheimer Co., Cincinnati, Ohio, including Sight Feed lubricators, oil and grease cups, and oiling devices. Tables and price lists are included with each article. Size 3½ by 6.

High Grade Tools Schuchardt & Schutte, 136 Liberty street, New York, are issuing a catalogue devoted to their high grade pliers, nippers, pinchers, folding machines, etc. Each line is handsomely illustrated and in an effective manner. Size of catalogue 6 by 9.

Wood Working Machinery. A beautifully designed cover is used on this catalogue, issued by Baxter D. Whitney & Son, Winchendon. On opening the catalogue it is found that the same artistic effect is carried on throughout where the wood-working machinery manufactured by this firm is illustrated and described. The history of the rise of this company, artistically illustrated, takes up the major part of the catalogue, while the latter part is devoted to illustrating and describing machinery. Size 5¾ by 8.

Catalogue of Books. A very complete catalogue has recently been issued by Spon & Chamberlain, New York, containing 188 pages. It is a descriptive catalogue relating to books on marine, mining, electrical and steam engineering. This catalogue should be in the hands of all desiring information of the different classes of technical books published. A card addressed to the publishers will bring copy. 4¾ by 7¼ in size.

Fire Proof Windows. A. B. Ormsby, Limited, Toronto and Winnipeg, have issued a large and attractive catalogue relating to their fire proof windows, floors, sky lights, etc. Illustrations of applications of different kinds of the different lines of their manufacture are shown. This is a high class catalogue, and is worthy of perusal by manufacturers and those contemplating building. 88 pages, 6¾ by 10½.

Iron and Steel Works Equipment. Finely printed and well illustrated catalogue issued by the Wellman, Seaver, Morgan Co., describing the Wellman patented open hearth charging apparatus. Illustrations are further given of installation of these recently made and now in operation, as well as lists of firms who are using the same.

The Gronkvist Drill Chuck. McLean & Sophus, St. James street, Montreal, are sending out an illustrated catalogue of this chuck which is manufactured by Schuchardt & Schutte, Liberty street, New York. It is new to the Canadian market and possesses features that should recommend it to users in this country. 15 pages, 4 by 7.

Mechanical Machinists' Tools. 1905 catalogue of Brown & Sharpe Mfg. Co., Providence, R. I., has been received lately, describing the machinists' tools, for the high grade of which this firm has a world wide reputation. Besides the descriptions and illustrations of the tools, some important tables are given. Every machinist should have a copy of this catalogue. It will be sent on request. 164 pages; size, 6 by 9 inches.

International Kerosene Engines. The International Power Vehicle Co., Stamford, Conn., are sending out a catalogue describing their kerosene oil engine and its economy in the many applications to which it is adapted. Size, 6 by 9 inches.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

LARGE THREAD MILLING MACHINE

A NEW development in the manufacture of milling machines is shown in a large thread milling machine manufactured by Pratt & Whitney Co., New York. It is designed to take up work up to 12 inches in diameter and 48 inches in length. Some of the features in connection with this machine will prove of interest to readers. As will be seen from the general views, the drive for work, cutter and lead screw is by means of a three-step cone pulley at the upper end of the bed. This, in connection with a two-speed countershaft, gives the cutter spindle six rates of speed, ranging from 31 to 65 turns per minute; while through the medium of a gear box, whose mechanism is controlled by a pair of handles, twenty-four rates of rotation in either direction are obtained for the work spindle to each speed of the driving shaft. Change gears, of course, connect spindle and lead screw to give the cutter carriage any desired rate of feed per turn of spindle, and automatic stops release the carriage feed in either direction at any desired point.

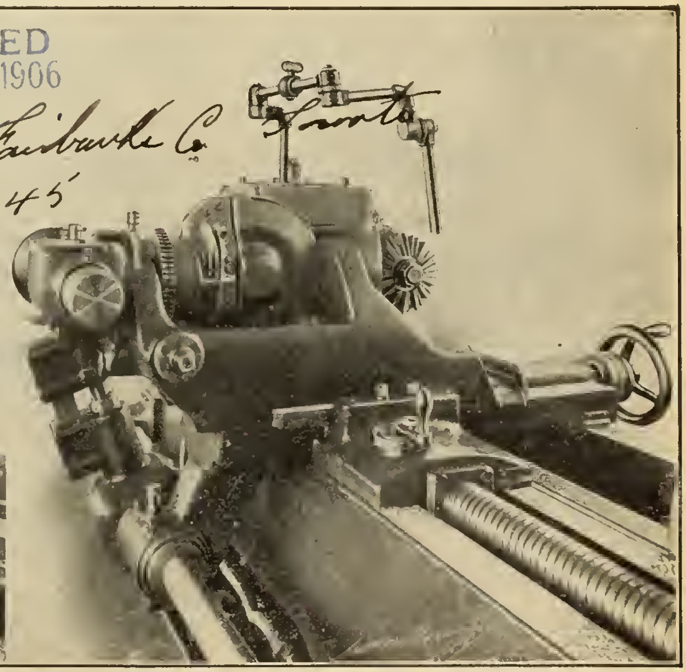
The swiveling cutter head is so mounted on the carriage that the point of the cutting tooth is always at the same height as the centre of the work, no matter at what angle the cutter spindle may be tilted. Graduations are provided on one of the head trunnions to give the correct settings for the helix angle and the head is easily adjusted by a crank-operated worm and worm-wheel. A nut with pinholes for a spanner is fitted as shown to the front trunnion and clamps the cutter head firmly after it is set. The carriage may be moved along the bed by turning a handle at the front of the headstock (thus actuating the lead screw) and its position may be very nicely adjusted by means of a small handle just above the feed nut, this handle serving to rotate the nut upon the screw. For setting the cutter to the precise depth in the work, the cross-feed screw carries an adjustable micrometer dial which is set at zero when the cutter tooth just touches the outside of the work. The carriage is then run back to clear the cutter from the piece and the cutter brought forward by the micrometer cross-feed screw to the correct depth.

A Large Spring Cut in Thread Miller.

For multiple threading and spiral gear cutting an indexing ring is provided for the machine. This ring is attached to a sleeve on the spindle and connected with the driving gear by a pawl which may be lifted by means of a latch operated from the other side of the gear. This indexing pawl is seated firmly between two steel abutments secured to the gear, and, when dropped into place, locks the spindle positively against any motion relative to the gear.

The machine is equipped with an attachment for relieving hobs. It consists of a rockshaft which is mounted in a bracket fitting the cross-slide guide on the carriage, and has a spring plung-

Head Stock of Miller.



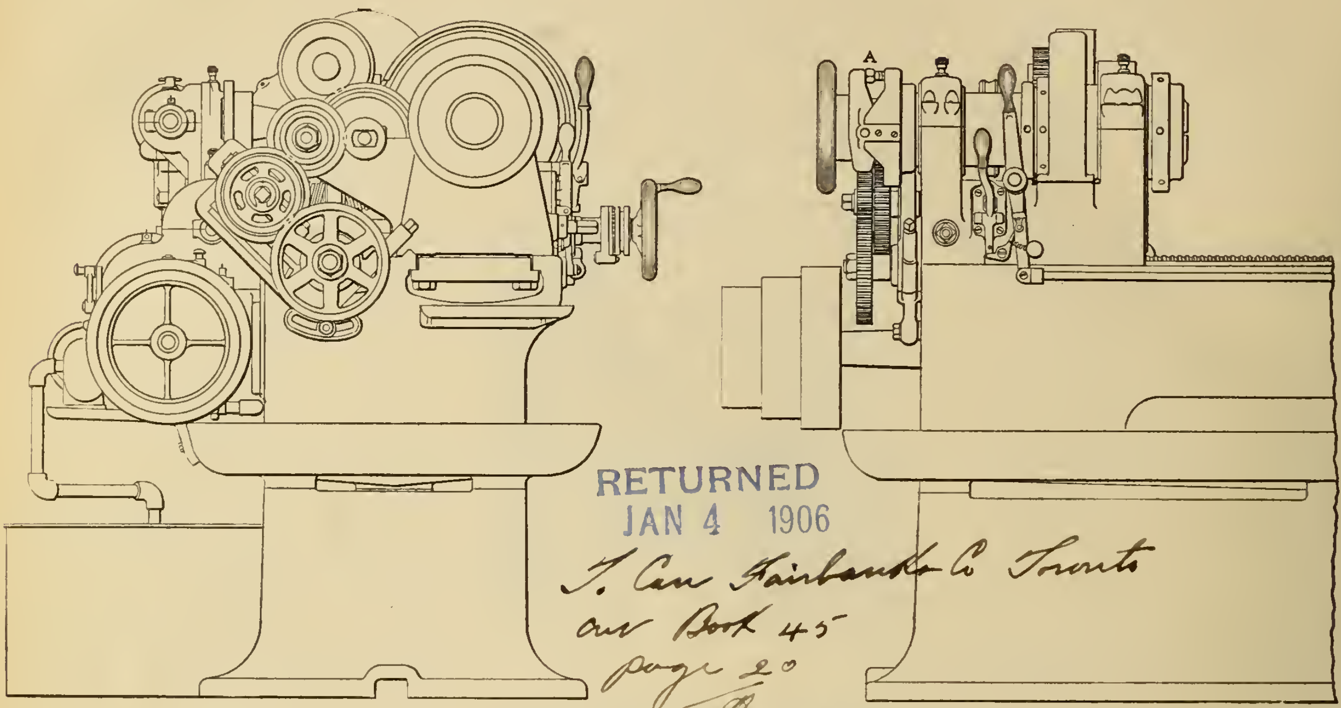
The Carriage and Cutter.

er seated in the attachment and pressing against the front of the cutter side.

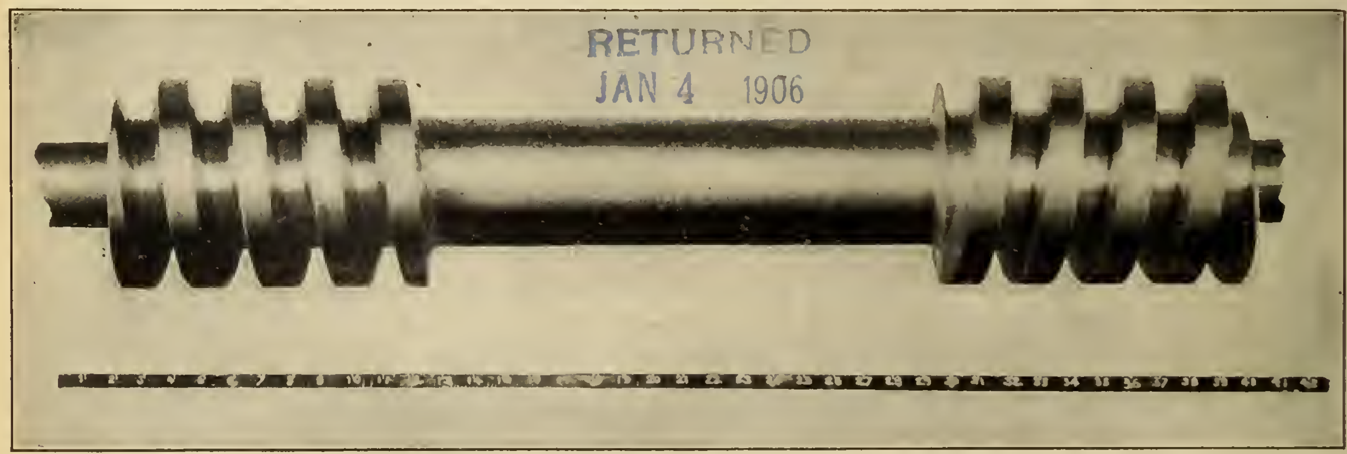
Some idea of the character of the work which the machine will handle is given from the illustrations, the first of these showing a double worm shaft, made from a tough steel forging about $5\frac{1}{2}$ feet long over all, the threaded portion being $7\frac{1}{4}$ inches diameter by $10\frac{1}{2}$ inches long, with a lead of $2\frac{1}{2}$ inches, and a depth of thread of about $1\frac{3}{8}$ inches. Two cuts were taken in the thread, about $\frac{1}{4}$ inch on a side being left for the second cut. A 5-inch cutter running at 36 turns per minute was used, and the first cut—over an inch in depth and measuring along the helix 97 inches—was taken in $1\frac{1}{4}$ hours, the machine taking the cut easily and producing a very smooth surface. This same piece is shown in position in the machine with the cutter operating in the right-hand thread. The shaft is shown supported at the middle in a steady-rest, while the outer end runs in a bushing slipped into the footstock.

The spring (a special job recently handled on this thread miller) is 10x24 inches, and was cut from an oil-tempered steel forging which had to be annealed before it could be chucked out. The boring was done on a gun-barrel driller and the shell was then driven on an arbor and milled to form the spring. Two cuts were taken, the total time being approximately 10 hours.

As indicated in several views, ample provision is made for keeping work and cutter cool, all cuts on this machine being taken under a flood of liquid. The hollow spindle in the head has a $3\frac{3}{4}$-inch hole through the drawing-in tube and maximum collet capacity of $3\frac{1}{2}$ inches, and the spindle bearings are $6\frac{1}{4}$ x 4 and $5\frac{3}{4}$ x $3\frac{1}{2}$ inches. The three-step driving cone takes a 3-inch belt and its largest step is 16 inches diameter. The two speeds of countershaft are 320 and 440 turns per minute.



Elevations of Head End of Thread Miller.



Double Worm Shaft—Cut in Thread Miller.

NEW BALANCING MACHINE.

McLean & Dawson, machinists, of Guelph, have recently invented a new balancing machine, which, however, is not yet on the market. The machine in question is being tested in Toronto and if found to satisfy the expectations of its inventors it will be at once manufactured in large quantities.

NEW ELECTRICALLY-DRIVEN TOOL ROOM GRINDER.

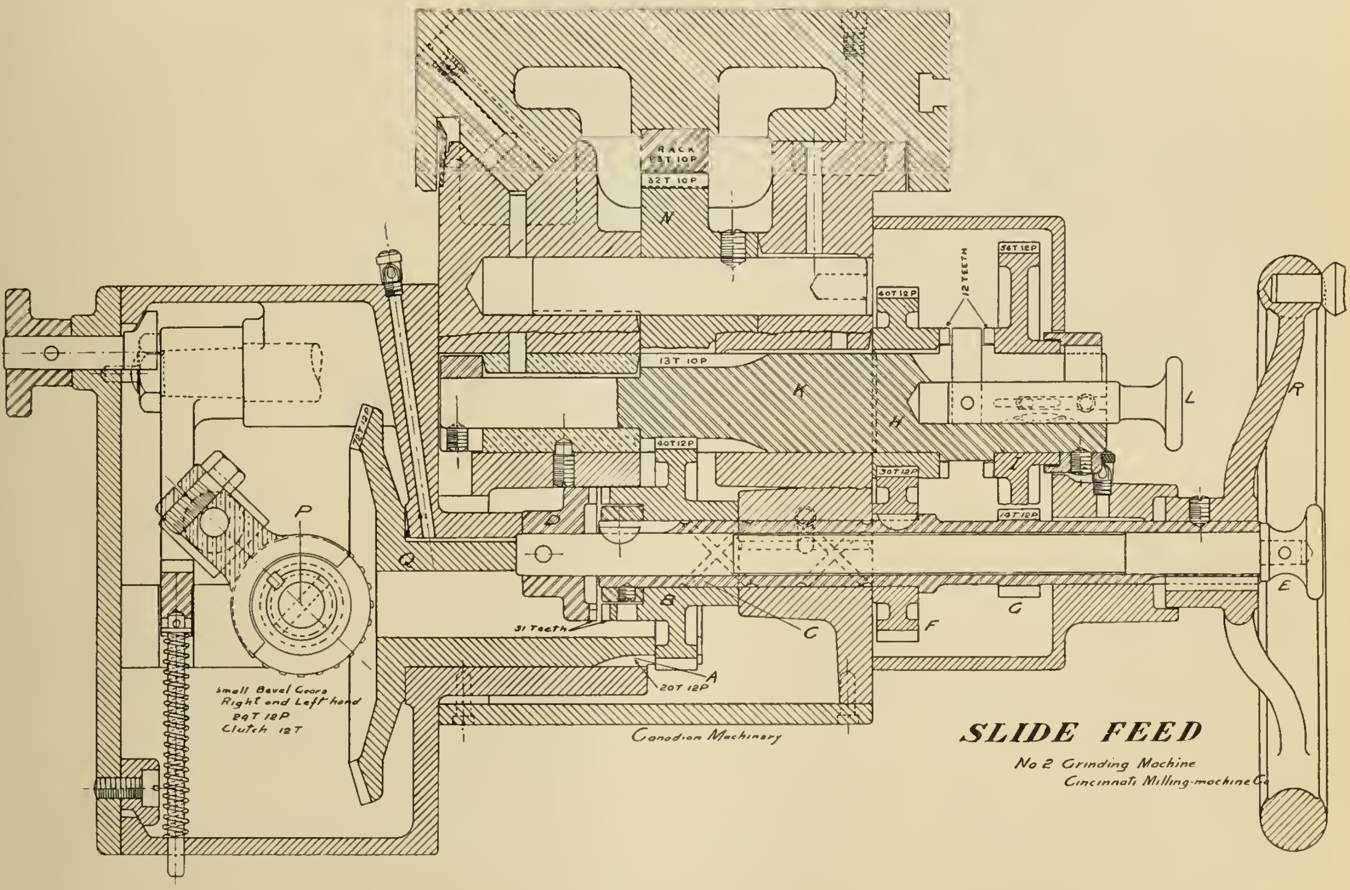
THE machine shown in the following illustrations, built by the Cincinnati Milling Machine Co., Cincinnati, Ohio, is arranged for direct connected motor driving, it being provided with a motor on the base for the main drive, and a smaller motor mounted on the head centre for rotating the work. It is, of course, built also as a countershaft-driven machine, the countershaft having tight and loose pulleys and driving direct to the machine with a constant speed belt, the different required wheel speeds—four speeds from 1,800 to 4,300 per minute—being provided for in the machine itself. A separate variable speed countershaft is driven from the first countershaft for rotating the work for cylindrical or internal grinding.

This machine is constructed especially with a view to meeting the demand for a substantial grinder for sharpening the large spiral mills and face mills that are in general use on large milling machines. In carrying out this idea in its design, care was taken that its adaptability for this large work should in no wise affect its thorough adaptability and convenience for sharpening the smallest cutters and reamers in common use. It takes work 36 inches between centres, swings 12 inch diameter. It is provided with an automatic feed of 24 inches. This thoroughly adapts it for a general line of cylindrical, surface, internal, and disc grinding, making it a complete universal grinder in every sense. Photograph No. 220 shows a general view of the machine. Its construction is further shown by the detailed drawing.

It is constructed on the knee and column plan, somewhat similar to a milling machine, the swiveling movements being obtained by setting the emery wheel head at any angle up to 90 degrees either right or left, bringing either one of the emery wheels into any desired relation to the work. The head centre, on which the majority of cutters are held for grinding, is provided with swivels in both the horizontal and vertical plans, thus further facilitating the angular settings. For grinding taper work, the table itself may be swiveled about a fixed centre, being provided with an engine-divided dial reading in degrees and also a taper scale in inches to the foot.

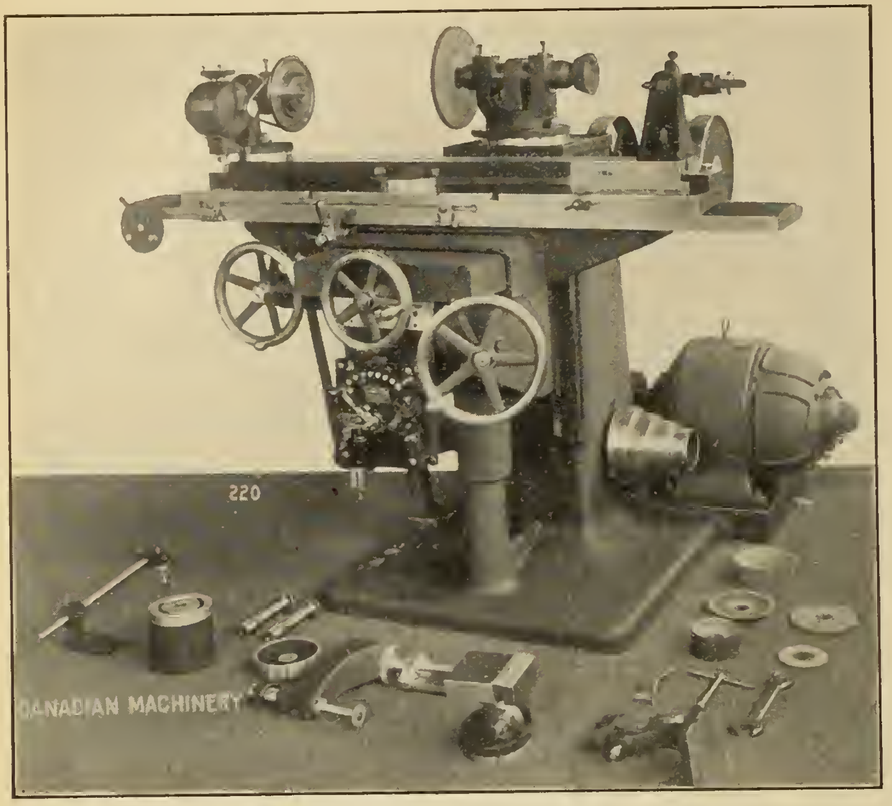
The motor drives up to a plain pulley on the middle of the upper speed shaft at the rear of the machine, then from the large four-step cone down to a small cone on the lower speed shaft, which has its bearings in the column near the base, and a pulley on the middle of this shaft drives vertically up to the pulley on the emery wheel spindle. This drive permits the swiveling of the emery wheel head in either direction without interfering with the running of the belt. The automatic feed is driven from the small four-step cone pulley on the left hand end of the upper speed shaft, which drives to a corresponding cone near the base of the machine. On the same shaft with the latter is a pulley which drives direct by means of a flat belt to the feed box mounted on the cross slide of the machine, the latter belt passing over weighted idler pulleys and being of sufficient length to accommodate itself to the cross range of the machine.

The drawing shown is a section through the slide and feeding mechanism. Power is transmitted by the above mentioned belt direct to the shaft "P," which carries a pair of small bevel gears running free on the shaft end, engaging the large bevel gear "Q" on



Detail of Slide Feed—New Tool-Room Grinders.

opposite sides. Between the small gears is placed a clutch, which may drive either of these gears and forms part of the reversing mechanism. Power is transmitted from thence to the large bevel gear "Q," on the hub of which is the pinion "A." The latter drives the clutch gear "B," which runs free on the quill "C," and drives the quill when the clutch "D" is engaged. The quill "C" also carries the spur gears "F" and "G," which mesh with clutch gears "H" and "I," respectively, the latter two gears running free on the hub of the pinion "K." "K" in turn drives the idler "N," which engages direct with the rack on the slide. From this it may be seen that the automatic feed can be started and stopped by means of the knob "E," which controls the clutch "D." By means of the knob "L" either one of the clutch gears "H" or "I" can be made to do the driving, giving a change in speed in the ratio of three to one, and in connection with the four-step feed cones provides a total of eight different rates of automatic feed. The feed of the machine may also be operated by hand through the hand wheel "R." In this case, the clutch "D" is disengaged, and a fast or slow movement may be obtained by means of the clutch "L," the same as when the automatic feed is used. The automatic reverse for the power feed is accomplished by means of adjustable dogs, which are clearly shown on the front of the slide in several of the half tones.



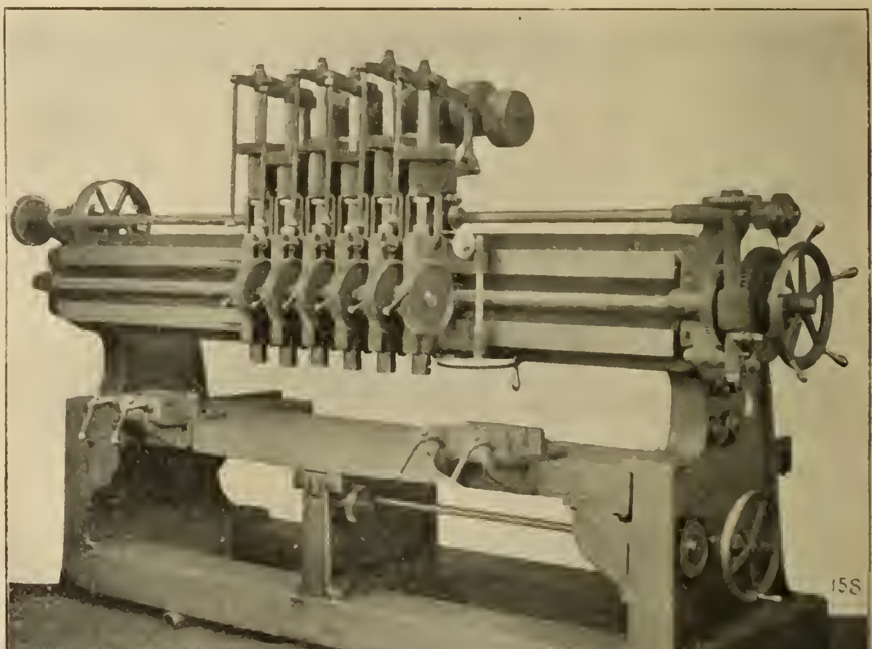
Electrically-Driven Tool-Room Grinders.

MUD RING DRILL.

A NEW mud ring drill is illustrated herewith which the Bickford Drill & Tool Company, of Cincinnati, Ohio, are just placing on the market. The chief characteristic of the machine is that while it was designed especially for mud ring drilling it is equally well adapted to all operations of multiple drill work.

Instead of the heads sliding on an auxiliary rail as in the ordinary construction they adjust directly on the main rail which enables them to be spread to any desired centre distance, each head being provided with independent adjustment. For mud rings or other similar work, where it is desirable that the heads should adjust collectively, the heads are clamped together by means of two quick-acting nuts which fix the centre distance between spindles at $7\frac{1}{2}$, 8, $8\frac{1}{2}$ or 9 inches as may be required. A dial on the worm wheel in the upper corner of the right hand head shows the distance through which the heads are moved to the right and left.

The speed and feed changes are obtained by means of change gears which are held in position by spring plungers, thus enabling the operator to change quickly from one speed or feed to another without lessening the available power of the machine. A dial on the large worm-wheel at the right shows where to set the dog to trip the feed at any desired depth. The spindles are 1 13-16 inches in diameter, have a vertical movement of 12 inches and work to



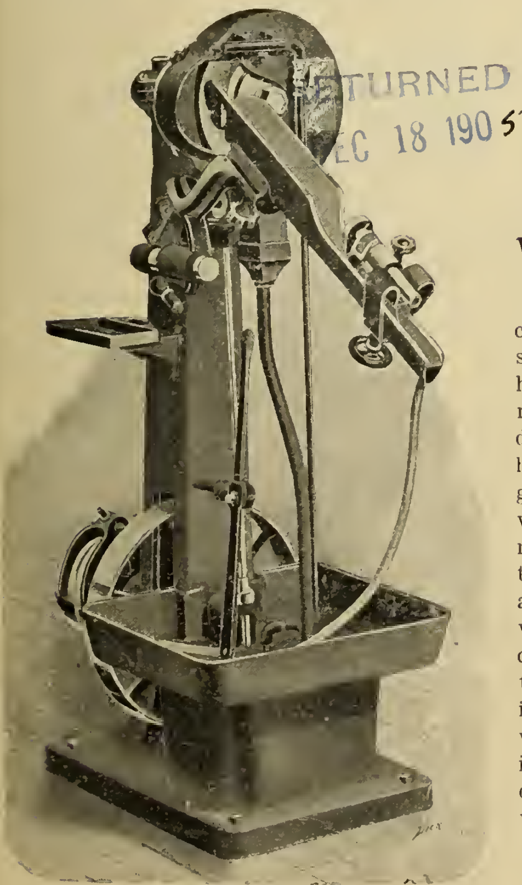
Mud Ring Drill made by Bickford Drill and Tool Co.

a maximum centre distance of $26\frac{1}{4}$ inches. The table has a transverse movement of 24 inches and receives between housings with a 12-foot rail 10 feet, 6 inches. Driven by a constant speed pulley the power is never less than that obtainable from a 5-inch double belt running at 1,696 feet per minute. The net weight of the machine is 17,500 lbs.

NEW YANKEE DRILL GRINDER.

A MACHINE recently designed by Wilmarth & Morman Co., Grand Rapids, Mich., is shown in two illustrations, although the machine is made in a great variety of styles.

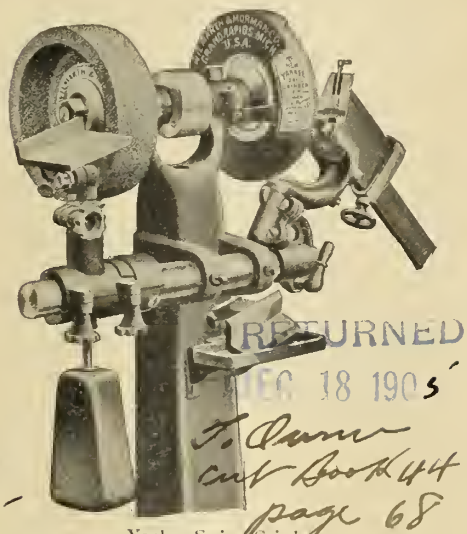
Figure 1, "P," is a wet drill grinder, having a capacity of drills from $\frac{1}{8}$-inch to $2\frac{1}{4}$ inches. Water is supplied to the emery wheel by the centrifugal pump, which type is particularly well adapted to the pumping of gritty water as there are no rubbing contacts anywhere, no stuffing boxes, no packing, not a bearing under water or in any manner exposed to wet, grit or dirt. The pump is liberally designed and supplies a large amount of water which is applied to the wheel just above the drill and prevents overheating even when grinding heavily. The drill grinding features are the same in all sizes and styles and have



Yankee Wet Drill Grinder.

this peculiarity that there is so little adjusting to grind a drill that the operation is practically reduced to "lay the drill in the holder and grind it." Many of these machines are made in combination with other forms of grinding machines, which greatly increases the value in the shop.

The upper portion of one of these is shown in Figure 2, which machine is designated as style "B Swing." Besides drill grinding the swinging attachment may be used for a great variety of work and will do most of the work for which disc grinders are recommended. Cutters, chasers, punches, dies, keys, gibs, tools and a multitude of small machine parts, it is said, can be ground better and quicker than these could be filed, planed or milled.



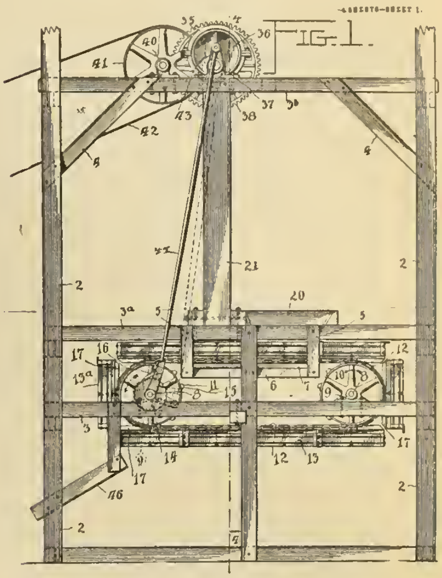
Yankee Swing Grinder.

SECURING VALVES TO CANS.

W. F. BRODERICK, Vancouver, has secured a United States patent on a new means for securing valves to cans without using solder, which is described as follows : A hollow screw projecting from and communicating with the valve-body, a shoulder or seat surrounding such screw, a hollow connecting-screw designed to engage the screw projecting from the valve-body and provided with an interrupted flange, corresponding radial interruptions in the circumference of the aperture in the vessel with which the valve is designed to communicate, and a check or stop to limit the rotation of the flange of the connecting-screw on the inner side of the vessel whereby the valve may be screwed upon the connecting-screw and the shoulder of said valve drawn tight against the outside of the vessel.

PROCESS OF MAKING WOOD PULP.

Patent No. 788633, issued to George S. Cushing, St. John, N.B. It relates to the process of producing wood pulp by mechanical means, and its object is to produce a pulp of superior quality in



Machine for Pressing Wet Peat.

a simple apparatus with a minimum expenditure of power. While the process for this purpose usually consists in grinding logs of pulp wood under great pressure, the present invention contemplates using refuse wood of any size, bark, sawdust, etc., as a raw material, which operates advantageously for the economy of the process. The present invention contemplates the reduction of this refuse wood to small chips in a suitable mill, and the resulting small chips are then cleaned in a suitable apparatus and thereafter are ground in a grinding belt of special construction. In this manner a pulp is produced of fine quality and of heavy fibrous nature, especially adapted for making good brown paper or cardboard without the addition of other fibrous materials.

IMPROVEMENT IN PUNCHES.

A few months ago a new turret punch manufactured by Talor & McKenzie was described in this department. Since then this punch has been re-designed and instead of being capable of taking bent iron of nothing greater than $4\frac{1}{2}$ inch width it is now adapted to punching holes as far as $2\frac{1}{2}$ inches from the edge of any width of sheets. This firm are rapidly pushing forward and are about to go into the manufacture of wood-working machinery, including saw tables, buzz planers and wide lathes, which they now manufacture, and general lines of wood-working machinery such as is required in planing mills, saw mills, etc.

The new factory of the H. K. Wampole Co., Perth, Ont., is nearing completion, and will be ready for occupancy about February 1st.

Companies Incorporated

The corporate name of Canadian Ladder Co. has been changed to Robinson & Turner Mfg. Co.

The license to do business in the province of Ontario by the Buffalo Tool & Machine Co. has been revoked.

The license of J. M. Kohler, Sons & Co., of Wisconsin, has been revoked to do business in the Province of Ontario.

The Mount Forest Carriage Co. have been granted permission to increase their capital stock from $50,000 to $100,000.

The Plymouth Cordage Co., of the State of Massachusetts, has been authorized to manufacture cordage in Ontario, provided they do not use any larger amount of capital than the sum of $80,000.

Calder Grain Shocker Co., Hamilton, share capital $30,000, purpose to manufacture grain shockers. The directors are:—J. Calder, G. S. Bingham, J. J. Morton and H. Rader, all of Hamilton, and A. R. Wardell, of Dundas.

The Great West Wire Fence Co., Winnipeg, share capital $100,000; purpose, to manufacture wire fencing. The directors are T. Black, W. A. Morkill, W. L. Belyea, W. M. Andrews, and C. W. Bradshaw, all of Winnipeg.

Window Glass Machine Co. of Canada, Cayuga, share capital $40,000, purpose to manufacture and sell glassware. The directors are: M. McClung, M. McConnell, J. W. Sheppard, D. P. Foster, and A. K. Goodman, all of Cayuga.

The Fleming Aerial Ladder Co., Toronto, share capital $100,000; purpose, to manufacture and deal in ladders and hoists. The directors are Thomas Wylie, George Henry Townsley, and Robert Fleming, all of Toronto.

Cobalt-Merchants Mining Company, Toronto, share capital $200,000, purpose to do the business of a mining, milling, reduction and development company. The directors are H. B. Wills, R. Falconer and W. Vandusen, all of Toronto.

The International Mfg. & Supply Co., Windsor, share capital $40,000; purpose, to make, construct, use and vend to others certain inventions. The directors are Leonard Walter Ashley, Walter Bong and Samuel Keal Peck, all of Windsor.

Clinton Threshing Co., Clinton, share capital $50,000, purpose to manufacture threshing machines, engines and other machinery. The directors are:—D. A. Forrester, Goderich, and W. W. Farran, W. Jackson, W. Gunn and C. Hovey, all of Clinton.

West, Taylor, Bickle & Co., Toronto, share capital $20,000; purpose, to manufacture and sell and deal in brooms, baskets, mops, matches, wash boards, etc. The directors are G. West, E. J. Taylor, W. J. Bickle, J. W. Berney and S. Smith, all of Toronto.

Temiskaming Reduction Works, Cobalt, share capital $166,000, purpose to carry on the business of a mining, milling, reduction and development company. Directors to be: Peter Kirkegaard, of Delora, and C. L. Benedict and G. Ritchie, of Toronto.

The Silver Five Mining Co., New Liskeard, share capital $40,000, purpose to carry on the business of a mining, milling, reduction and development company. Directors are: J. Matthews, W. McKnight, D. Stewart, W. Roebuck and H. Loudin, all of New Liskeard.

Adjustable Axle Nut Co., London, share capital $30,000, purpose to manufacture and sell the Williams Adjustable sleeve axle nut. The directors are:—R. C. Williams, John Sussex, and A. Simpson, all of London; and W. T. Pridham and W. E. Davis, of Toronto.

Banwell-Hoxie Wire Fence Co., Hamilton, share capital $100,000, purpose to manufacture and sell woven wire and other fencing. The directors are: Henry Banwell, Walkerville; and Elizabeth Brett, Agnes Waldie MacGregor and James Edward Banwell, all of Windsor.

St. Catharines Building & Paving Co., St. Catharines, share capital $50,000, purpose to manufacture products of cement, etc. The directors are:—J. T. Petrie, F. A. Henry and A. W. Marquis, all of St. Catharines, and C. E. Secord, township of Grantham, and W. H. Swayze, township of Louth.

Canadian District Heating Co., Hamilton, share capital $250,000, purpose to produce natural gas, electricity, steam, and hot water for lighting and heating purposes. The directors are:—W. W. Stewart, W. J. Clark, R. B. Griffith and W. P. Witton, all of Hamilton, and J. H. Williamson, of Toronto.

The Standard Tin Works, Toronto, share capital $40,000, purpose to buy, sell, manufacture and otherwise work and deal in tin, iron copper, brass and other metals. The directors are to be: T. H. Cook and R. MacKenzie, of Sarnia, and J. A. McGolpin, W. F. Boddy and H. F. Bodd of Toronto.

Canada Turpentine Co., Ottawa, share capital to be $200,000; purpose, to manufacture, sell, refine and deal in turpentine, wood alcohol, acetic acid, creosote, etc. The directors are R. A. Sibbitt, A. K. McLaren, A. McKillop, and F. X. Laderoute, all of Ottawa, and J. A. Thompson of Winnipeg.

The Anglo-American Varnish Co., Montreal, share capital $20,000; purpose, to manufacture, buy, sell, and deal in varnishes, Japan lacquers, driers, oils, etc. The incorporaters are W. Marshall, G. M. Ballard, T. F. Clarknall, of Newark, N.J.; and P. Davidson and A. Wainwright, Montreal.

The James Robertson Co. have secured a charter in New Brunswick to carry on their plumbing supply business in the Maritime Provinces. The capital stock is $70,000, and the incorporators are J. H. M. Robertson, C. M. Robertson, A. M. McMichael, Jas Robertson, and A. Robertson, all of Montreal.

Canada Carb-ox Co., Winnipeg, share capital $30,000; purpose, to manufacture and sell the carb-ox system of smoke consuming apparatus. The incorporators are James Stuart, Jacob Nichols Yeomans, William Stephenson, all of Winnipeg, and Joseph Weller Hays, Chicago; and John Graham, of Winnipeg.

The Shirreff Manufacturing Company, Brockville, share capital $50,000, purpose to manufacture carpet sweepers, step ladders and other wood and metal articles. The directors are: C. J. Shirreff, G. A. Shirreff, W. P. Shirreff, W. M. Osborne, and B. R. Shirreff, all of Brockville, and G. A. Shirreff, of New York, N.Y.

The Silver Gulch Mining & Prospecting Company, Cobalt, share capital $75,000, purpose to carry on the operations of a mining, milling, reduction and development company. The directors are L. H. Timmins, T. J. Harwood, of Mattawa, R. A. Cartwright, Belleville, W. C. LeHeup, Cobalt, and D. A. Dunlap of Haileybury.

Ontario Minnesota Mining Co., Port Arthur, share capital $60,000, purpose to carry on the operations of a mining, milling reduction and development company. The directors are:—J. D. Ensign, G. A. Elder and V. Stearns, Duluth, Minn.; W. W. Blackshaw, West Superior, Wis.; and G. F. Piper, of Minneapolis, Minn.

The Water Supply Co., Montreal, share capital $40,000; purpose, to promote and organize companies for the supply of water, gas and electric light. The incorporators are Maurice Rousseau, Montmagny, Que.; Arthur Eugene Brunet, William John White, Lacasse Rousseau, and Arthur William Patrick Buchanan, all of Montreal.

Temagami Mining & Milling Co., Toronto, share capital $40,000, purpose to carry on the business of a mining, milling, reduction, smelting and development company. Directors to be C. L. Beckwith, L. O. Hedden, W. E. Thatcher, J. B. Wilson, F. L. Luff and E. J. Meeker, all of East Orange, N.J., and R. N. Brundage and F. F. Guild, of Newark, N.J.

The Cambrian Mineral Co., Sudbury, share capital $100,000; purpose, to carry on the business of mining, milling, smelting, refining, or otherwise dealing with metal, minerals, coal oil, or any other substance connected with same. The incorporators are R. G. Leckie, J. E. Leckie, W. J. Montgomery, all of Sudbury, and R. G. Edwards of London, England, and D. G. Gillies of Montreal.

The Big Dipper Mining & Milling Company, Peterboro, share capital $2,500,000, purpose to carry on the business of a mining, milling, reduction and development company. The directors are: S. Sager and J. S. Waldron of Peterboro, J. M. Fletcher and J. J. Tisdale of Buffalo, N.Y., A. J. Reed, E. R. Wilson, B. F. Hayward and G. H. Bradley, all of Bolivar, N.Y., and J. Jamieson, Barrie, Ont.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

REPRESENTATIVES of a syndicate of American steel manufacturers are negotiating with the Fort William Board of Trade regarding inducements for the erection of a steel finishing mill, employing not less than 200 men at Fort William.

Bickford & Mackay will erect a knitting mill at Dundas.

The Canada Cordage Co. are to locate their factory at Glencoe.

Capital invested in Canadian mining amounts to $104,000,000.

The Miramichi Lumber Co. will build a saw mill at Chatham, N.B.

A large creosoting plant is to be established at Dartmouth, N.S.

W. H. Fogwell is constructing a $2,000 brick residence in Hamilton.

Canada's mineral production has increased 600 per cent. since 1886.

A new hotel is being erected by Messrs. Dean and Mortlach, Sask.

The Empire Lumber Co. will erect a large saw mill at Latchford, Ont.

The Dominion Natural Gas Co., Brantford, are erecting a new building.

John Wilson, Collingwood, will erect a pork packing plant in Edmonton.

David Gibb, Vancouver, has purchased a site and will erect a $30,000 hotel.

J. S. Emerson, Vancouver, is building a new saw mill at Greenway Sound.

The Winnipeg Paint Co., Winnipeg, will erect a branch factory in Edmonton.

The Ontario Asphalt Block Company may remove from Walkerville to Stratford.

Yukon placers have produced more gold than any other placer mines in the world.

The Turnbull Elevator Co., Toronto, will erect a three-story factory to cost $6,000.

A new industry to manufacture the Hanson Car Coupler is to be started at Madoc.

A new Y.M.C.A. building to cost $60,000 is to be erected in Winnipeg next Spring.

The Brantford Felt & Rubber Company has purchased considerable new machinery.

A branch factory of the London Fence & Machine Co. may be established at Brandon.

The capital stock of the Pembroke Electric Light Co. has been increased to $150,000.

Another lime burning plant is to be established in Owen Sound by David Chalmers.

The J. C. Graham Lumber Co., Winnipeg, will erect a large warehouse in that city.

The Norton Mfg. Co., Hamilton, are to erect a $10,000 brick addition to their factory.

The Fairchild Co. have purchased a site for a large warehouse, to be erected at Regina.

The Whyte Packing Co., Stratford, are building an addition to their works at that place.

The Wolverine Cedar Lumber Co., Menominee, Mich., will erect mills at Spanish Mills.

The Canadian Flax Cordage Co. are negotiating with the town of Berlin for a factory site.

A by-law to grant $20,000 to the Aylmer Iron Works was carried at Aylmer, Ont., this week.

The Empire Wall Paper Co. of Toronto intends to open a branch of the business in Winnipeg.

Mr. J. P. Smith will erect a factory in Vancouver for the manufacture of mining machinery.

The Galt Knitting Co., Galt, are erecting a large concrete addition to their other works.

The R. Watt Machine Works, Ridgetown, are to manufacture the Bidwell Threshing Machine.

Weibe & Rompel, Laughan, Sask., are erecting a flour mill there with a capacity of 125 barrels a day.

The Canadian Electric Force Company is being organized at Victoria, B.C. A. Maxwell Muir is secretary.

A representative of a Detroit company manufacturing rattan furniture has been looking for a site at Sarnia.

Nickel was accidentally discovered in Sudbury in 1882. Canada has produced $35,000,000 worth of nickel.

The American-Abell Engine & Thresher Co. are to build a large addition to their warehouse at Regina.

Dundas Council have decided to install a filtering plant and make improvements to the reservoir.

Construction work has commenced on the new $600,000 factory of the Plymouth Cordage Co., Welland.

For the fortnight ending October 31 92 building permits were issued in Toronto, the cost being $525,000.

Representatives of an Ohio concern manufacturing hay presses, etc., have been looking for a site at Guelph.

Haslem's saw mill at Nanaimo is to be operated again, having been purchased by J. S. Emerson, Vancouver.

The producer gas plant, manufactured by the Waterloo Mfg. Co., of Waterloo, is being installed in Owen Sound.

Natural gas is expected to be ready for sale at Brantford, St. George and Galt during the next week or two.

The capital stock of Strathcona Coal Co., Fredericton, N.B., has been increased from $120,000 to $200,000.

The Canadian General Electric Co. and the Canada Foundry Co. will erect a warehouse 140 x 40 feet in Winnipeg.

The Dominion Government are to erect a modern emigration and detention hospital at Quebec, to cost $60,000.

Thomas Shafer and H. J. Mills, of Philadelphia, propose to establish a boot and shoe factory at New Westminster.

The Ontario Portland Cement Co., of Brantford, are making very large shipments of cement from their works near Paris.

The construction work has commenced on the factory to be erected by the Manning Wood Fibre Co., at Owen Sound.

A small seam of coal has been unearthed by workmen excavating for a building on Westminster avenue, Vancouver.

The Northern Electric Mfg. Co. will erect a factory to cost $115,000 at the corner of William and King streets, Montreal.

The Trent Valley Woolen Mills at Campbellford intend building a new dam. John S. Fielding, C.E., is preparing plans.

Prospectors report the discovery of indications of iron ore in Nipegon district, New Ontario, over an area covering 50 miles.

The Vancouver Nail Works were recently destroyed by fire. at a loss of $50,000. The building and plant were partly insured.

It is the intention of W. H. Snyder & Co., manufacturers of the Berlin piano, to enlarge the capacity of their plant in the near future.

The Cornwall Furniture Co., Cornwall, Ont., have almost completed the new brick addition to their already well equipped factory.

The Dominion Coal Co. has commenced work on a new building to be used as a foundry at Glace Bay. The cost will be over $25,000.

The Granby Curling Club, Granby, Que., are erecting a new rink 152 feet by 36 feet, the whole to be covered with corrugated iron.

The foundry of the Canadian Aluminum Works, at Chambly Canton, Que., is being recovered with Pedlar's Perfect Rubber Roofing.

The Dickson Co., Peterboro, will erect a large planing mill at that place for the manufacture of sash, doors, blinds, interior fittings.

The Robertson Machinery Company has recently been organized at Welland to manufacture hoisting machinery and contractors' plants.

The Wellington Colliery Company, Cumberland, B.C., are making extensive

improvements to their new anthracite mine at Hamilton Lake.

The C.P.R. has taken over on a long lease the Tillsonburg, Lake Erie & Pacific Railway and will operate it as part of their Ontario division.

Welsh coal exporters are looking for new markets and are anxious to give eastern Canada a fair trial with their best grades of anthracite.

Mr. J. H. Helm will build a concrete dam at Port Hope. John S. Fielding, consulting engineer, Toronto, is preparing plans and specifications.

The Canadian Northern Railway has been constructed as far west as Edmonton, this being the first railroad to enter the new capital of Alberta.

Work has been commenced on Vancouver's first wheat elevator, on the site which Messrs. Hall & Son, of Winnipeg, secured from the C.P.R.

St. Catharines is to have a new industry, the manufacture of scientific products having been commenced by the St. Catharines Building & Paving Co.

John Studebaker, the great wagon manufacturer of the United States, is looking into the possibilities of opening a branch factory at Fort William.

The L. H. Packard Co., Montreal, will erect a handsome $40,000 factory on St. Antoine Street. It will be a five-storey building, brick and stone.

The strike at the Kingston Locomotive Works, which has been on for nearly four years, has been called off by the International Association of Machinists.

At the last monthly meeting of the Canadian Railway Club, held in the Windsor Hotel, Prof. R. J. Durley, of McGill University, read a paper on "Economy in Steam Power Plants."

Chas. J. Boon, Toronto Junction, has commenced work on a large solid brick building, 45 x 128 feet, and four storeys high, for an American brush company.

The Canadian Bank of Commerce have purchased a site in the centre of the business district of Halifax for $60,000, and will erect a modern bank building.

The Bank of Toronto is to erect a new building in Toronto. It will be four storeys high, built of stone, brick, steel and concrete, and will cost $130,000.

The Montreal Carriage Leather Co., Montreal, have recently changed their transmission equipment from self-oiling bearings to Chapman Double Ball Bearings.

For the purpose of establishing a gas plant at Manitou the Manitoba Gas Company has been granted incorporation with an authorized capital stock of $7,500.

A match factory is to be established at Sarnia. The factory will be in connection with the Cleveland-Sarnia mills. It will give employment to 100 or more hands.

A Montreal fur manufacturing company are to erect a three-storey building at Brandon. Over 60 employes will be given work when the building is completed.

The Chapman Double Ball Bearing Co., Toronto, are equipping the new plant of J. Leckie Co., Limited, Vancouver, B.C., with their double ball bearings.

The Cape Breton Coal & Iron Co. are doing considerable development work and contemplate opening large areas of coal beds near Cochrane's Lake, on Cape Breton Island.

The Vinning Machine Co., manufacturers of concrete block machines, have located at Niagara Falls, and are installing machinery in a factory building they have secured.

It is announced that the Brantford Street Railway will change hands this week. The purchasers are unknown. Big improvements and extensions are contemplated.

J. Finlay, Norwood, intends erecting a new concrete factory, 65 x 85 feet, next season. Norwood Council will give the firm a fixed assessment, the only inducement asked.

The Russell Electric & Hydraulic Co., recently held a meeting at Chatham, N. B., and decided to undertake the manufacture of a new roller bearing invented by W. H. Russell.

Atlin miners report a particularly profitable season in gold mining this year owing to the milder weather, and more gold will be brought out from there this year than ever before.

The brick work on the foundry extension at the Peterboro Lock Works has been completed. As soon as the works close down for stock taking the new machinery will be put in.

Raymond, Alberta, is installing a water supply tank of 10,000 gallons capacity, operated by an air motor pumper. The outfit is being suplied by the Devlin-Tyrrell Co., of Winnipeg.

A new foundry, under the management of Forwell Bros., has been established in Berlin, where it is intended to make a complete line of soil pipe and fittings, and all kinds of castings.

The Brantford Ice Co., Brantford, intend to erect a large ice house. A fine plant of machinery for elevating ice will be installed, and the capacity of the building will be 8,000 tons.

The J. Y. Griffin Co., of Winnipeg, have secured a site in Fort William on which they will erect a large plant to carry on their business similar to that in Winnipeg.

The output of the Dominion Coal Company's mines for October was 333,317 tons, and shipments amounted to 323,887 tons. This creates a new high record for the company.

A New Brunswick foundry, Fredericton, are manufacturing the attachments for looms to be used in textile mills, they having secured the right to manufacture this machinery in Canada.

A report from the Assistant Commissioner at White Horse states that a rich vein of gold ore a mile and a half long has been struck in the Montana mines. It is said this is worth $12,000,000.

The city permits of Winnipeg show an increase of over $1,000,000, and they continue to increase. Permits were issued last week by the building inspector for structures valued at $25,000.

The by-law granting a loan of $12,000 to the Jackson Wagon Works Co., St. George, was carried by a majority of 839 in the town of Galt as an inducement to have that company locate there.

The Dominion Bridge Co., owing to the volume of business done in the West and the extensive railway construction sure to take place, have decided to establish a plant and yards at Winnipeg.

The Chapman Double Ball Bearing Co., Toronto, are installing the complete transmission equipment in the Ottawa Lumber Co.'s mill, including their double ball bearings, shafting, hangers, etc.

The total cost of building erections at Swan River, Man., during the year is $55,000. This village has passed the experimental stage, and with the splendid surrounding country its future is assured.

Messrs. Whalen & Bowman have closed an agreement with the town of Fort William in return for certain inducements, they have agreed to build a large machine shop and dry dock, employing fifty men.

Winnipeg financiers are preparing to erect a pipe and tile factory at Medicine Hat and a company known as the Great West Sewer Pipe & Tiale Co. is being promoted at a capitalization of $1,000,000.

A seam of coal 5 feet thick and about 30 feet from the surface has been struck at Turtle Mountain. The quality is said to appear superior to the ordinary Souris coal, and tests are to be made at other points.

Plans are being prepared for the construction of the new City Flour Mills, St. Thomas, for George Adcock, on Southwick street. The main structure will be four storeys high, besides a ten-foot basement.

The new zinc reduction works at Frank, Alberta, commenced operations last week. A large quantity of ore was retorted and made into pig zinc, the ore coming from the Goodenough mines at Kaslo, B.C.

The Dominion Coal Co. will apply to the Tariff Commission to protect the soft coal industry against British coal which is brought out as ballast and entered at a very low duty under the preferential agreement.

Two steamers having a tonnage of 7,000 each, to be launched next Spring, are to be built in England to the order of a Norwegian firm this Winter for the St. Lawrence coal-carrying trade of the Dominion Coal Company.

The town of Cornwall has passed a by-law to loan $20,000 without interest to Thomas McGill and a company formed by him for the manufacture of chairs. The loan is to be repaid by installments within the next twenty years.

W. J. Pendray & Sons, Victoria, have commenced building a new factory on the wharf where the old building used to stand. The brick building is also be-

ing altered in order that the soap-making machinery may be installed.

A deal has taken place by which the Bugaboo iron mines in the Alberni district, Vancouver Island, have become the property of Seattle people. It is expected that development will be commenced at once on a large scale.

There was a large attendance at the meeting held at the King Edward Hotel, Toronto, November 27, to prepare resolutions for presentation at the Provincial Mining Convention to be held in Toronto on the 12th of December.

The rail mill of the Dominion Steel Co. at Sydney has been out of operation for about a week on account of an accident to the main engine of the plant. The mill has been turning out an average production of five tons per day.

Messrs. G. M. Hanson & M. N. McKusick, of Calais, are to erect at once, near Charlotte Station, a new steam saw mill, which will be equipped with all modern machinery necessary for the manufacture of long and short lumber.

The owners of the Sullivan mine in Kootenay, B.C., are considering the proposition of enlarging the smelter to a capacity which will enable it to treat not only all the company's ore, but also that of other mines in the same district.

The Dodge Mfg. Co., of Toronto, have just closed a contract with the Northern Sulphite Co., Sturgeon Falls, Ont., for several carloads power transmission machinery, being the complete shafting equipment for the new sulphite mill.

The people of Kingston will vote on a by-law in January to exempt the Canadian Locomotive Works from taxes for ten years. If the by-law carries the company agree to enlarge their works. The capacity now is sixty engines per year.

Work has commenced on the Dominion Coal Co.'s big electrical plant at Dominion No. 2. Excavation for a foundation for the power house is commenced. This building will be about 66 by 120 and already operation on the collieries has commenced.

Survey parties are prospecting at the head waters of the Skeena River, B.C., and it is reported that coal has been found in large quantities in this district. Seams are found running in all directions, cropping out from the ground in many places.

The lumber districts along the northern branches of the Rouge River, Que., are quiet this year, as the big lumber companies are cutting their wood only in the lower parts. This is rather seriously affecting the hardware trade in the upper districts.

New machinery will be required for the Shakespeare mine at Kenora, which is now being operated under the supervision of J. C. Foley, a well known Ontario mining man. The output of this and facilities for mining are expected to increase very largely.

The Dominion Government has purchased a site for a new examining warehouse for the Customs Department in Winnipeg. The land was owned by Mackenzie and Mann, and they received $88,125 for it. The building will be erected next Summer.

The Roebling Construction Co., of New York and Buffalo, contractors for the fireproofing of the McGill Union building, Montreal, have placed their order for lathing, furring, etc., to be used in that edifice, with the Pedlar People of the same city.

The Canada Saw Co. are removing their factory into a larger premises at Ottawa. The statement that the company intend to remove from Ottawa is denied. The company intends to enlarge its factories in Toronto and St. John during the coming year.

Weston, Ontario, will continue municipal ownership for the electric light plant for some time at least. Recently the council rejected the offers of the Stark Telephone, Light & Power Co., of Toronto Junction, and the Southern Light & Power Co., of Erindale.

The crushing plant of the American Asbestos Co., at Black Lake, has been increased recently by the addition of two 40 x 6 Farrel Bacon style "B" Duplex crushers, of which the Jenckes Machine Co., Limited, of Sherbrooke, Que., are sole builders in Canada.

The new Singer Sewing Machine factory at St. Johns, P.Q., is now nearly completed, and represents an outlay of about a million dollars. Unlike other plants of the company, this will be the only one where the famous Singer machines will be made complete.

The Cataract Power Company will soon be able to furnish 13,000 more horse-power to industries in Hamilton. It has completed the electric line from Hamilton as far east as Bronte but will not be able to connect with the Mimico line into Toronto till next year.

Application is to be made to Parliament at its next session for an Act to incorporate the Buffalo, Niagara and Toronto Railway Company, with power to construct a railroad from Niagara-on-the-Lake to St. Catharines and Port Colborne. It is also to touch at Fort Erie.

The Canada Tap & Die Company has purchased the Clark-Demill building at Galt and will commence as soon as possible the manufacture of taps, dies, screw-cutting tools and other machinery. The promoters are interested in similar industries in the United States.

The Window Glass Machine Co., of Pittsburg, have recently ordered from the Smart-Turner Machine Co., Limited, Hamilton, three electric hoisting machines, and the Princess Quarries Co., Bancroft, have installed a 6-ton hand power traveling crane of this company's make.

C. J. Hurt recently disposed of the Carberry, Manitoba, flour mills, to an American syndicate represented by Bruce Howard, of Minneapolis. The purchasers, it is said, intend to establish a string of mills throughout the west and manufacture for the export trade.

Montreal circles are greatly interested in the rumors of a deal between Allis-Chalmers and the General Electric Co., to control the electrical business of the United States. In the Montreal plant of Allis-Chalmers-Bullock extensive reorganization schemes are under consideration.

The Manitoba Iron Works, Limited, of Winnipeg, have completed the water tower contracted for with the town of Portage la Prairie and Engineer Chipman has passed same as entirely satisfactory. This is the largest contract of the kind yet undertaken in Western Canada.

The Nordheimer Piano Co., Toronto, have decided to start work on the additions to their factory this Fall. The building will be 45 x 28 feet, and will be four storeys high. It is understood that an American firm, manufacturing brushes, will occupy a portion of the building.

The Tavistock Milling Co., of Tavistock, Ont., have installed a new coal-unloading elevator in their new coal shed. The elevator is the first of its kind in Western Ontario and has a capacity of thirty tons of coal an hour. The machine was put in position by Mr. J. K. Lemp.

Thorold Foundry & Machine Co. are about to secure a patent for the manufacture of farm implements, said patent not before being exploited in Canada. There is said to be no competition along the line of the patent so that there will be every opportunity for a large and strong industry.

The Dodge Mfg. Co., having recently increased the storage facilities in their Montreal branch, now have complete stocks there of all their standard lines in power transmission machinery, for immediate delivery. These include all such material as illustrated in their condensed list No. 25.

Peter Beachler, Sombra, and the Robb Engineering Co., Amherst, N.S., have each ordered from the Smart-Turner Machine Co., Limited, Hamilton, a Duplex boiler feed pump and in addition to this the Robb Engineering Co. are installing one of their independent air pumps and jet condenser.

The Dodge Mfg. Co., of Toronto, have just completed the erection of a substantial brick power house, and have installed an additional 300 h.p. in boiler capacity. This has been necessary in order to keep pace with the constant extensions and additions going on in this company's model works.

A Detroit company intend to erect a smelter at Argentine near Haileybury. This smelter will be in running order by Christmas, and will handle all ore worth from $25 up. This company, it is stated, intended originally to erect a smelter at North Bay, but have been induced to locate at Haileybury.

The Improved Match Co., Limited, is the name of a new enterprise that has been established by a number of prominent Montreal business men, with a capital of between $75,000 and $100,000. The company has purchased a large brick factory at Drummondville, where the works will be situated.

Building operations in Montreal during October show that 131 permits for new buildings were issued at a cost of $559,049. Permits for alterations numbered 29, and the amount involved was $80,374. This made a total amount invested in building operations last month of $675,423. The increase over the corresponding month of last year was $399,393.

Sheldon & Sheldon, of Galt, have recently installed their systems in the two moulding shops of Gurney-Tilden Co., the Otis Fensom Elevator Co., and the Union Drawn Steel Co., of Hamilton. Besides these they have placed equipment in the Bertram plant at Acton and the Lang tannery in Berlin.

The Cartierville Electric Light & Power Co. have secured a 25 year franchise for the lighting of the town of Bordeaux. The same company has also the contract for furnishing light and power to the town of St. Laurent, Que. Mr. Charles Brandeis, C.E., of Montreal, is the consulting engineer.

The Home Telephone Co. is negotiating with the city of Vancouver for the installation of a new automatic telephone system in that city. The company is installing a $1,000,000 plant in Portland and state that they are prepared to spend $1,000,000 in Vancouver if a satisfactory agreement can be arrived at.

The annual meeting of the Rand Drill Company was held at Sherbrooke a week ago. The financial statement as submitted to the shareholders showed a remarkably good record of expansion during the past year, and it was decided to proceed at once with the enlargement of the plant at Sherbrooke, Que.

The Standard Paper Company have been negotiating with Cannington for the establishment of a paper mill there. The company want right-of-way, cash bonus of $10,000 to build an electric railway for their own and public use. The company will undertake to build a mill to employ steadily from 40 to 50 men.

The Jenckes Machine Co., Limited, Sherbrooke, Que., is furnishing the Standard Chemical Co., Limited, of Toronto, two 100 h.p. 66 in. diameter by 16 feet long horizontal tubular boilers, and five wood alcohol storage tanks 17 ft. in diameter by 16 ft. high. Boilers and tanks will be shipped to Montreal.

The Government bounty on pig lead produced in Canada has been reduced owing to the standard price of the lead in London. The bounty was formerly 75 cents per hundred pounds, providing the total did not exceed $500,000 a year. The increase in price in London has caused a reduction in the Canadian bounty.

Work has begun in grading the roadbed for the new railway between Three Rivers and Shawinigan Falls. The chief engineer in charge of the construction is Mr. Ross McRae, who is assisted by Mr. Burrell of Burrell's Siding. It is expected that the track will be laid as soon as the frost leaves the ground in the Spring.

Negotiations have been begun to establish a new industry at Kingston, Ont., for the manufacture of lap-welded iron and steel tubes for marine, stationary and tubular boilers, also wrought iron pipe for gas, steam and water. It is understood that an attempt is being made to interest Kingston capital in the venture.

The Jenckes Machine Co., Limited, of Sherbrooke, Que., has recently shipped a 14 in. by 20 in. double drum Lane friction winding engine, drums 72 in. diameter by 36 in. face, to the Dominion Coal Co., Limited, Glace Bay, C.B., and is at work on a single drum hoist of the same size for the same company.

The Keystone Sugar Co., Whitby, have let the contract for the erection of their new factory to a Michigan construction company, the price being about $15,000. The structural steel used in the deserted factory at Wiarton, and the machinery of the same plant will be transferred to Whitby. The work is to be completed next August.

F. F. Powell & Co., Montreal, have received a contract from R. E. T. Pringle & Co., of the same city, for roofing the buildings of the Simplex Railway Appliance Co., at Bluebonnets. The same firm are also supplying upwards of four hundred sheet copper doors for the Grosvener Flats, Guy street, Montreal.

A suggestion is made that Canada shall cancel the subsidy to the Canada-Australian line of steamers, on the ground that the recent regulations regarding the valuation of imports by the Australian Commonwealth is a discrimination against Canadian trade. The subsidizing of a direct line to New Zealand is advocated instead.

The Vancouver Nail Factory has been destroyed by fire, the loss being estimated at $100,000. The building had been erected against the Vancouver Engineering Works, and the exertions of the firemen were concentrated on one spot for the purpose of saving this big plant, which they ultimately did. The factory will be rebuilt.

Mr. Albert J. Pitkin, president of the American Locomotive Co., who died recently at his home on Riverside Drive, New York, was well known in Montreal, having succeeded the late Samuel R. Callaway as the executive head of the American Locomotive Co., and of its Canadian branch, the Locomotive & Machine Co. of Montreal.

I. Shantz, of Berlin, is building a large gasometer for the town of Berlin. It is made of sheet iron of different thicknesses and is being installed at the Municipal Gas Plant. The new gasometer is being placed outside the former one and adjusted in such a manner that it slides over it and thus doubles the capacity of the plant.

Walter H. Laurie, engineer, through his attorneys, Messrs. Greenshields, Greenshields, Macalister & Languedoc, is applying to the Superior Court for an injunction to restrain Mr. John M. Mackie, liquidator of the Laurie Engine Co., from using in the manufacturing business of the company a certain patent owned by the petitioner, for improved feed water heaters.

Records were broken in the output of the Dominion Steel Company's open hearth furnaces and blooming mills last month. The open hearth shows a tonnage of 18,915, an increase of 3,837 over any other month in the company's history while the blooming mills produced 15,262 tons, exceeding the output of any previous month by 1,246.

The total output of the Dominion Coal Co. for October was 333,317 tons. Shipments amounted to 323,884 tons. The total output of the collieries for September was 322,288 tons, and shipments were 299,403 tons. The total output for October shows an increase over that of last year of 11,029 tons, and increase in shipments of 24,461.

The United States Steel Corporation have announced that about 2,500 acres of land in Indiana on the shore of Lake Michigan has been purchased in the interest of the United States Steel Corporation, which will erect thereon blast furnaces, open hearth furnaces, by-product coke ovens and various mills for the manufacture of a diversity of steel products.

A plant is to be established near Tweed to utilize the silver ores of Hastings County and to extract sulphuric acid by the context. The Canadian Chemical Co. will invest $1,500,000 in the plant and the enterprise will greatly stimulate the mining interests of New Ontario and will make possible the working of large bodies of ore not yet developed.

The first grain elevator in Vancouver, and the first of many, it is fondly hoped by those who are struggling to turn Alberta wheat this way, is now under construction. Messrs. C. E. Hall & Sons, of Manitoba, are the firm engaged in erecting the elevator, which is of large cauacity, and the builders say that it is to be followed by a large flouring mill for export trade.

The Dominion Coal Co. intend to instal quite an extensive electrical plant at their No. 2 colliery, near Sydney. The Canadian Westinghouse Company are the successful tenderers. Up to the present the company have been utilizing steam and compressed air, but it has been found that electrical transmission would be more economical and altogether an improvement.

English capital stands ready to purchase the Lenora and Mount Sicker mining properties and all assets, and if the private sale planned to take place in Victoria on Wednesday, November 23, is interfered with the legal representatives of the assignees of mortgages on the properties fear the deal may fall through. The price to be paid for the property is $100,000.

A water company is being formed at Dawson to install a system in the Klondike hills. This is separate from the big scheme which the Dominion Government has had in hand all the past season, for bringing water to practically all parts of the benches and hillsides of the Klondike. O. R. Brener and Messrs. McDonald, Barrett, Palmer, McNamee, Hitchcock and Kelly are the incorporators.

W. M. Dougall, president of the Kootenay Power & Light Co., estimates the cost of installation of the new machinery at Bonnington, on the Kootenay River, B.C., together with the pole lines, will be about $1,000,000. The company will have 28,000 h.p. for industrial purposes and expects the lines into the Boundary will be ready for transmission purposes in March or April.

The Canadian Northern Railway Company has ordered forty new locomotives, which may be increased to sixty, four hundred flat cars, one thousand box and

stock cars and several hundred passenger cars. This new equipment is for delivery during 1906 and if Canadian firms can meet the company's demands the orders may all be increased. An expenditure on equipment exceeding $2,000,000 is anticipated.

The Smart-Turner Machine Co., of Hamilton, are meeting with signal success in placing their pumps and jet condensers on the market. Among some of the recent orders received by them, some of which have now been installed, are Standard Duplex pumps for the Merchants Rubber Co., Berlin, the Great Lakes Dredging Co., Port Arthur, P. S. Russell & Son, New Liskeard, and Barrie Tanning Co., Barrie.

The Hamilton Bridge Co. have secured the contract for the structural steel work for the new plant of the American Glass Co., at Cayuga. Before deciding to build at Cayuga the company had representatives make a thorough test of the sands available and the natural gas supply. The company has agreed to employ 400 men when the works commence operations next year and this number will likely be increased to 1,000.

The city of Vernon, B.C., is embarking on a municipal electric lighting venture. Steam power will be used for driving the generator. The steam plant will consist of a 250 h.p. 14 and 26 by 36 Jenckes-Corliss steam engine; horizontal return tubular boilers, 9 x 14 x 16 independent jet condenser, boiler feed pump and feed water heater, all complete, and recently shipped by the Jenckes Machine Co., Limited, Sherbrooke, Que.

The Canadian Northern Railway has secured $6,000,000 in England, and it is understood that the company will early next Summer begin the construction of their transcontinental line between Port Arthur and Montreal, and that within three years Montreal will be connected with the Saskatchewan River by three distinct railway systems. It is understood that the new line will be built between the C.P.R. and the Grand Trunk Pacific.

Messrs. B. E. Pearson and J. Johnson, of Halifax, who have taken up a large field of coal areas adjoining the territory which is now being developed by the Standard Railway & Coal Co., have succeeded in interesting a number of wealthy capitalists from Pennsylvania in the property held by them, and it is their intention to make borings and to otherwise prospect their areas in the view of opening up mines in that section of the country.

Vancouver city has now concluded a contract with the B. C. Electric Co. renewing its street lighting contract for ten years, on a much reduced basis. Hitherto the rate has been $93 for open arc lights, but new type lamps are to be installed and the rate is to be $38 per year. The company offered to allow the contract to commence now, instead of next June, when the old contract terminates, the saving thus effected being over $15,000.

The Granby Consolidated Mining & Smelting Co. are making important additions to their crushing and hoisting plant. These additions include a mammoth ore crusher of the Farrel-Bacon jaw type, the capacity of which will be 1,400 tons for eight hours ; a new electrical hoist having capacity of 5 tons and speed of 700 feet per minute is also being installed. Both of these machines are being built by the Jenckes Machine Co., Limited, Sherbrooke, Que.

The Waterous Engine Works, of Brantford, has been awarded the contract to supply a new 800-gallon fire engine for addition to the Vancouver city fire department's equipment. This was awarded after competitive bids had been twice called for. The price was $5,000, the Canadian Fire Engine Co. having bid $5,200. On the first bids the Waterous people were $5,700, but were high, and as the fire chief reported in favor of the Waterous engine the new bids were called.

Among recent installations made by R. Whitelaw, of Woodstock, the product of their engine works are: 85 h.p. boiler in the Ingersoll Nut Works; 40 h.p. engine and boiler for Edward Buller & Son, Vittoria; a 40 h.p. engine for Zimmerman Bros., Tavistock, Ont.; complete 50-barrel flour mill to the Osprey Farmer Milling Co.; another mill installation to William Hay & Co., Ailsa Craig, Ont.; complement for machinery for E. Carlaw, Belleville, Ont., who is remodelling his mill.

At the annual meeting of the Canadian Rand Drill Co., held at Sherbrooke, the financial statement, as submitted to the shareholders, showed a remarkably good record of expansion during the past year of the company's business. The retiring directors were re-elected excepting that Mr. Rand and Mr. Brainard were replaced by Mr. Doubleday and Mr. Grace, of the Ingersoll Rand Co. The president was authorized to proceed at once with the enlargement of the plant at Sherbrooke.

The Granby Consolidated Mining, Smelting & Power Co., Phoenix, B.C., has placed an order with the Jenckes Machine Co., Limited, Sherbrooke, Que., for another mammoth crusher of the Farrel Bacon style "B" pattern. The receiving opening of this crusher is 42 in. by 30 in. Its capacity per day of 10 hours in 1,400 tons of ore to 8 in. cube and the shipping weight is 120,000 lbs., the heaviest single piece weighing about 75,000 lbs. The Granby Co. already has two crushers of this same size in operation.

A great deal of interest is being taken in the many rich strikes of quartz on the Canadian side of Portland Canal this Summer. So many prospectors have been in the field this Summer that a great deal of new ground has been covered. As the new strikes are close to the portion of the international boundary being delimited since the recent award, the parties of surveyors sent out by the Government have been in a position to see what has been discovered, and they endorse previous reports as to the extent and value of the finds.

The Dominion Iron & Steel Co. has started on a 5,000-ton rail order for the Temiskaming Railway. Fifteen hundred tons of the I.C.R.'s 25,000-ton order have already been completed. The Dominion Steel Co. is reported to be arranging with the Nova Scotia Steel Co. for the exploration of submarine areas at Wabana. The N. S. Co. own areas lying outside those of the Dominion Co., and a slope will be driven down through from their present workings, which it is hoped will prove the existence of large and valuable bodies of ore in the areas of both companies.

A complete reorganization of the Montreal Street Railway Company has been decided upon by the directors. It is intended that the capital of the company will be increased from $7,000,000 to $12,000,000 and the value of the shares to be increased from $50 to $100. At the present time the Park and Island Company are indebted to the Montreal Street Railway Company over $800,000, and it is intended that the Montreal Street Railway buy out the Park and Island Company altogether and refund all the money owed. The Park and Island Company is controlled by the Montreal Railway Co.

The Granby Company, Grand Forks, B.C., have placed orders for important additions to their crushing and hoisting plants. These additions consist of a mammoth ore crusher of the Farren Bacon jaw type. The capacity of the crusher will be 1,400 tons to 8-inch cube every ten hours, and the shipping weight of the machine will be 120,000 lbs., the heaviest single piece weighing 75,000 lbs. The Granby Co. already have two crushers of this same size and type in operation. The capacity of the electric hoist will be a load of 10,000 lbs. Both the crusher and hoist are being built by the Jenckes Machine Co., Limited, Sherbrooke, Que.

Butterfield & Co., of Rock Island, Que., have during the past year added a large complement of machinery and tools to their plant for the manufacture of different styles of reamers, such as fluted chucking, Morse taper, ine. rose chucking, rose shell, shell, solid jobbers, short solid, taper pin, taper for bridge builders, taper for locomotive work, etc. etc. This firm has long been well known as manufacturers of taps and dies of all descriptions for screw cutting ; machinists' and blacksmiths' screw plates, mining cutters and kindred tools for which they enjoy a reputation that is only the outcome of high class material and workmanship.

The confidence of Cobalt miners in the future of that district is shown by the scale on which they are investing in mining machinery. M. J. O'Brien & Co., whose mine is on the edge of Cobalt Lake, recently bought from Allis-Chalmers-Bullock, Limited, a complete power house equipment, including boilers, hoisting engines, 7-drill compressor plant, boiler feed pump, large general supply pump, high speed engine and generator for electric lighting. The compressor is of the Ingersoll-Sergeant self-contained type, and the whole machine is mounted on a continuous box girder frame specially designed for heavy mining work.

Smart-Turner Machine Co., Limited, Hamilton, have placed automatic feed pumps and receivers with the Otis-Fensom Elevator Co., Hamilton, and A. R. Williams Machinery Co., Toronto ; a duplex outside back plunger pump with Cushion Bros., Calgary, Alta. ; a single vacuum pump with Toronto University ; a steam and oil separator and an automatic feed pump and receiver with the Beck Manufacturing Co., Penetanguishene. In addition to these the Westing-

house-Church-Kerr Co., New York, have placed an order for two of their duplex outside back plunger pumps with pot valves to be installed in the power house of the Ottawa Electric Co.

Negotiations are still in progress between Messrs. McGuire & Richards, the former principals of the Canada Machinery Co., of Sarnia, whose plant was unfortunately destroyed by fire in the town of Sarnia, but up to the present no definite agreement has been reached. The gentlemen mentioned are in a position to start a new company and begin operations at once for the erection of new works to employ 125 men and pay out $80,000 to $100,000 in wages annually. They asked from the town a free site and the loan of $25,000, the latter to be fully secured by mortgage. The question has come up in the Sarnia council and is now in the hands of an industrial committee.

A new iron field opened in Algoma is said to be the most important in the history of the Dominion. The ore is partly bessemer, with a large tonnage, running from .06 to .07 in phosphorus, too high to be bessemer, but up to about 61 per cent. iron. The deposits are located along the west side of the Vermillion River in Nipissing district, and extend for thirty to forty miles, much of the distance in an unsurveyed part of Algoma. The distance to the village of Killarney, on the north shore of Georgian Bay, is about sixty miles. If the statement prove true that this discovery is second in importance to the mining world to that of the Mesaba range alone, it argues a career of prosperity for our iron interests undreamed of a year ago. A railway can be run to the district connecting with the deep waters of the great lakes, making a rate to Cleveland and other lower lake ports of about $1 per ton, or sixty cents a ton less than the rate from Duluth.

Mr. Aubrey Spencer, sone of J. W. Spencer, head of the firm John Spencer & Sons, Limited, Newcastle, Eng., has recently been visiting in Montreal. The Spencer firm is one of the greatest of boiler plate manufacturers in England, and in addition manufactures castings, shells, steel for great guns, and other products. Mr. Spencer, who intends to visit the steel industries of Canada during an extensive tour of the country, states that never before has his firm seen greater activity in most branches of the business. A new process perfected and patented by Mr. Spencer's father, for high silicon steel, is proving very successful, and this is being used in the boilers of the two new Cunard liners now in course of construction. It is interesting to note that the process of making steel at the Spencer works is almost entirely the acid one, different from the Bessemer process employed on this side. The electrical process is hardly employed at all.

The Shawinigan Water & Power Co. has closed with the Westinghouse Company for a second 12,000 horse power generator, to be added to its present plant. An order for the first was placed with the same firm some ten months ago, and the Shawinigan Co. will presently have the two largest generators in use in Canada. Each will have a diameter of 28 feet. The new generator will be used largely in developing the mining districts of the province, particularly those relating to the production of asbestos. A considerable portion of the power, however, will be taken to Montreal for industrial purposes.

Another important concern has been added to the list of asbestos mining companies. This is the Asbestos Mining & Mfg. Co., which was formed by Providence, R.I., capitalists, and which will operate at Wolfstown, in the Thetford, Que., district, the centre of the asbestos industry. The capacity of the plant at the start will be 150 tons of ore a day, but it is the intention to increase this subsequently to 300 tons. The buildings are being erected at the present time, and the plant, which is being furnished throughout by the Jenckes Machine Co., Limited, of Sherbrooke, Que., comprises one 30 x 15 and two 20 x 6 style "B" Farrel Bacon rock crushers, one set 36 x 17 geared crushing rolls, two heavy pattern Cyclone pulverizers, one conveying and picking table 32 in. belt, 40 ft. centres, one steel revolving ore dryer 48 in. diameter, 30 ft. long, several revolving sizing screens, together with bucket elevators, all the transmission machinery required, also a pit plant consisting of vertical boilers, derricks, hoisting engine, etc., and a very fine steam plant made up of a 14 and 26 x 36 Jenckes Corliss engine; two 150 h.p. 72 in. diameter by 18 ft. long high pressure tubular boilers, condenser, boiler feed pump and feed water heater, all complete.

Extension to Factory.

In order to keep pace with their rapidly increasing business, the Thomas Davidson Mfg. Co. have found it necessary to extend their already large works both at Montreal and Winnipeg.

Their Montreal plant, which is situated at the corner of Albert and Dominion streets, Ste. Cunegonde, is being greatly enlarged by the addition of a fine four-storey brick wing, 220 feet long by 50 feet wide.

Nut Factory in Operation.

When in Ingersoll recently the representative of Canadian Machinery had the pleasure of seeing what is for its size one of the brightest and most up-to-date factory buildings to be seen anywhere. It is the new works of the Ingersoll Nut Co., and here will be manufactured on a large scale nuts of all descriptions. The machinery has been installed and ready for operation. The Grand Trunk siding runs past the building so that transportation facilities are of the best. A detailed write-up of these works will be given in a later issue of Canadian Machinery.

Toronto Engineers' Club.

During the month of November the meetings of the Engineers' Club of Toronto were of an interesting nature. At the first, on Nov. 9, a paper by F. A. Knapp, on tubular and roller boats, was read. On Nov. 23 a paper was given by Samuel Groves, editor of Canadian Engineer, being an "Historical Sketch and Description of the Bessemer Steel Making Process." A new departure was entered into on Wednesday, Nov. 29, when the members of the club met at business lunch at Harry Webb's.

Important Subject Discussed.

At the meeting of the electrical section of the Canadian Society of Civil Engineers for November two interesting papers were read by the authors, these being "An Electric Accelerometer," by R. B. Owens, and the other "Oscillographic Researches on Surgings in High Tension Lines," by C. David, abstracted with introduction by L. A. Herdt. At the meeting of the mining section papers were "Testing of Explosives Used in Engineering, by Dr. J. B. Porter; "Magnetic Concentration of Iron Sands," by J. F. Robertson; a note on a "New Apparatus for Surveying Deep Bore Holes," by Dr. J. B. Porter.

New Tap and Die Works.

The tool-making industry, and in particular the making of taps and dies in Canada, has received further impetus lately by the founding of the Canadian Tap & Die Co., Limited, of Galt, who have taken over the business lately conducted by Wm. M. Preston and have purchased the Clark Demill property near the C.P.R. station, where they will have ample facilities for carrying on an extensive business. Mr. Preston informed the representative of Canadian Machinery that the gentlemen who composed the company other than himself are interested in the manufacture of taps and dies in the United States and have an eye to the Canadian field, realizing the future there is in it.

PRACTICAL MECHANICS.

(Continued from page 464.)

must bear in mind that conditions also vary greatly.

A recent experiment made by the writer was with two flat pieces of cast iron carefully surfaced by scraping and then polished. The co-efficient of friction was found to be .16 without oil and when oiled .12. The oiling of flat surfaces does not, however, produce conditions similar to those that often obtain in well lubricated rotating parts in the case of which the end sought, and more or less frequently attained, is the maintenance between the rubbing surfaces of a thin film of oil.

We enter the field of fluid friction at this point and may find co-efficients as low as .003 when special lubricating devices are used.

We have stated two of the most frequently quoted laws of solid friction and would now add another, which, however, is limited in its application—friction is independent of velocity.

We will find in our simple experiments that it requires a little more power to start a body sliding than to maintain motion, thus proving that the friction of rest exceeds that of motion, and if we could experiment farther, getting up to speeds exceeding 150 feet per minute we would find that friction is less at the higher than at the lower speeds.

Laws of Friction.

Experiments with fluids are not so easily made as those with solids, so we shall here simply state the laws that have been demonstrated by Prof. Thurston, an eminent authority on the subject. In fluids, resistance is independent of pressure—directly proportional to area of rubbing surfaces—proportional to the square of the relative velocity at high speeds and to the velocity at low speeds—proportional to the density of the fluid. A scrutiny of these laws will show why the results of tests with lubricated journals show such departures from the laws of solid friction. Experiments with well finished steel journals running in bronze bearings at a surface speed of 700 feet, and lubricated in what we might call a very good manner for ordinary machine work, show these co-efficients:

Pressure per square inch, 50 lbs., 200 lbs., 300 lbs.

Co-efficient of friction, .0034, .0051, .0057.

Claims have been made for as low a co-efficient as .0007, when highly developed lubricating devices are used.

The numerous engineers' hand-books contain considerable data on the subject of friction and the student can find in them such information as may suit the circumstances of the case in hand, but it is hoped that these few words may have helped to clear away one or two misunderstandings about a matter that is not as thoroughly understood by practical men as it should be.

CONTENTS

General Manager Resigns.

Machinery circles in Montreal have been interested in the announcement made public a few days ago that Mr. H. H. Henshaw has resigned from the directorate and general managership of Allis-Chalmers-Bullock, Limited, of that city.

Mr. Henshaw spent his early childhood at St. Hyacinthe, Quebec, and afterwards, coming to Montreal, he entered the service of the Grand Trunk Railway. He gradually gained the recognition of Montreal business men, and was appointed secretary of the Royal Electric Co. When this company became merged with the Montreal Light, Heat & Power Co., Mr. Henshaw was chosen secretary-treasurer, a position which he occupied until last Spring. On June 1 last he was appointed director and general manager of Allis-Chalmers-Bullock, Limited, but has retired within the past few days.

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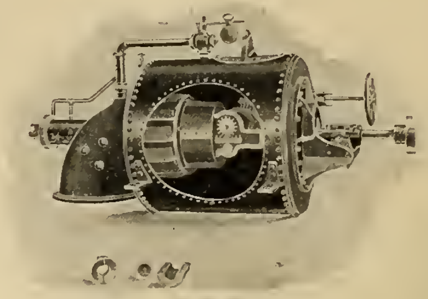

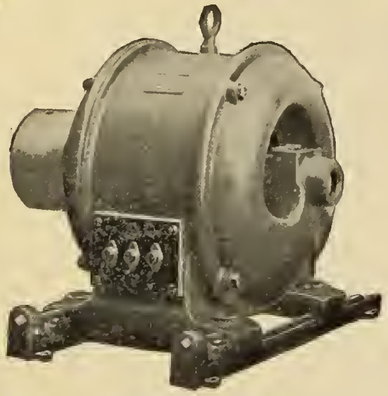

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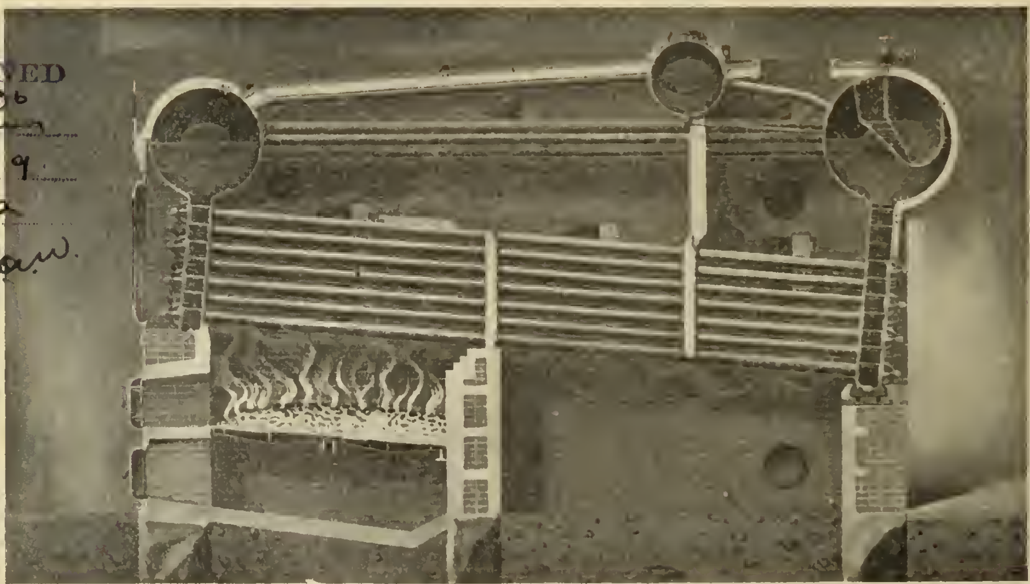

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(See Bulletin No. 32)

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MACHINERY BUYERS' DIRECTORY.

Readers of CANADIAN MACHINERY are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principa firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

Abrasive Materials.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.
Williams & Wilson, Montreal.

Air Brakes.
Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Air Receivers.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Arbor Presses
Niles-Bement-Pond Co., New York.

Augers.
Chicago Pneumatic Tool Co., Chicago.

Axle Cutter.
A. B. Jardine & Co., Hespeler, Ont.

Axle Setter and Straightener
A. B. Jardine & Co., Hespeler, Ont.

Babbit Metal.
Canada Metal Co., Toronto.

Barrels, Tumbling.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.
Niles-Bement-Pond Co., New York.

Batteries, Storage.
Chicago Pneumatic Tool Co., Chicago.

Bell Ringers.
Chicago Pneumatic Tool Co., Chicago.

Belting, Chain
Waterous Engine Works Co., Brantford.

Belting, Leather.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.
Williams & Wilson, Montreal.

Belting, Cotton.
Dominion Belting Co., Hamilton.
Sadler & Haworth, Montreal.

Belting Supplies.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.
Chicago Pneumatic Tool Co., Chicago.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Benders, Tire.
Boynton & Plummer, Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.

Blowers.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass

Boilers.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Owen Sound Iron Works Co., Owen Sound
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Boiler Plates
R. Sullivan David, Montreal.

Boiler Compounds.
Canada Chemical Mfg. Co., London, Ont.

Bolt Cutters.
National Machinery Co., Tiffin, Ohio.

Bolt and Nut Machinery.
A. B. Jardine & Co., Hespeler, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Books, Mechanical.
Technical Pub. Co., Manchester.
The MacLean Pub. Co., Ltd., Toronto.

Boring and Drilling Machines.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.

Boring Machine, Upright.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.

Boring Machines, Wood.
Chicago Pneumatic Tool Co., Chicago.

Boring and Turning Mills.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Box Puller.
A. B. Jardine & Co., Hespeler, Ont.

Bulldozers.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
National Machinery Co., Tiffin, Ohio.

Cabinets, Tool.
Armstrong Bros. Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Rice Lewis & Son, Toronto.

Calipers.
Brown & Sharpe, Providence, R.I.
Rice Lewis & Son, Toronto.
L. S. Starrett & Co., Athol, Mass.
Williams & Wilson, Montreal.

Castings, Grey Iron.
F. L. Hare, Oshawa, Ont.
Jenckes Machine Co., Sherbrooke, Que.
The Owen Sound Iron Works Co., Owen Sound.
Smart-Turner Machine Co., Hamilton.

Castings, Brass.
F. L. Hare, Oshawa, Ont.
Jenckes Machine Co., Sherbrooke, Que.
The Owen Sound Iron Works Co., Owen Sound.
Smart-Turner Machine Co., Hamilton.

Castings, Steel
Ottawa Steel Casting Co., Ottawa.

Cement Machinery.
Allis-Chalmers-Bullock Co., Montreal.
St. Lawrence Supply Co., Montreal.

Centering Machines.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
Pratt & Whitney Co., Hartford, Conn.

Centres, Planer.
Pratt & Whitney Co., Hartford, Conn.

Chemicals
Canada Chemical Co., London.

Chucks, Ring Grinding.
A. B. Jardine & Co., Hespeler, Ont.
Chicago Pneumatic Tool Co., Chicago.
McLean & Sophus, Montreal.

Chucks, Drill and Lathe.
John Bertram & Sons Co., Dundas, Ont.
Ker & Goodwin, Brantford.
Krug & Crosby, Hamilton.
A. B. Jardine & Co., Hespeler, Ont.
Jacob's Mfg. Co., Hartford, Conn.
London Machine Tool Co., London.
McLean & Sophus, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
W. T. Standish, Toronto.

Chucks, Planer.
Francis Reed Co., Worcester, Mass.
McLean & Sophus, Montreal.

Chucking Machines.
American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Potter & Johnston Mach. Co., Pawtucket, R.I.

Circuit Breakers.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Clippers, Bolt.
A. B. Jardine & Co., Hespeler, Ont.

Compressors, Air.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Concentrating Plant.
Allis-Chalmers-Bullock Co., Montreal.

Condensers.
Smart-Turner-Machine Co., Hamilton.

Consulting Engineers.
Canadian White Co., Montreal.
Charles Brandeis, Montreal.
John S. Fielding, Toronto.
Roderick J. Parke, Toronto.
T. Pringle & Son, Montreal.

Contractors.
Canadian White Co., Montreal.

Controllers and Starters. Electric Motor.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock Co., Montreal.

Conveyor Machinery
Jenckes Machine Co., Sherbrooke, Que.
Smart-Turner Machine Co., Hamilton.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Coping Machines.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.

Cotton Belting.
Sadler & Haworth, Montreal.

Cranes
Niles-Bement-Pond Co., New York.
Smart-Turner-Machine Co., Hamilton.

Crank Pin Turning Machines
Niles-Bement-Pond Co., New York.

Crushers, Rock or Ore.
Allis-Chalmers-Bullock Co., Montreal.

Cupola Blowers.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Cut Meters
The Canadian Fairbanks Co., Montreal.

Cutters, Flue.
Chicago Pneumatic Tool Co., Chicago.

Cutters, Milling.
Becker, Brainard Milling Machine Co. Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Machines.
John Bertram & Sons Co., Dundas, Ont.
Hurlbut-Rogers Machine Co., South Sudbury, Mass.
London Machine Tool Co., London.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Tools.
Armstrong Bros. Tool Co., Chicago.
H. W. Petrie, Toronto.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Cylinder Boring Bars.
H. B. Underwood & Co., Philadelphia.

Dies, Opening.
W. H. Banfield & Sons, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.
W. H. Banfield & Sons, Toronto.
The Globe Machine and Stamping Co. Cleveland, Ohio.

Dies, Threading.
W. H. Banfield & Sons, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Draft, Mechanical
B. F. Sturtevant Co., Hyde Park, Man.

Drawn Steel, Cold.
Canadian Drawn Steel Co., Hamilton.
Union Drawn Steel Co., Hamilton.

Dredges, Gold, Dipper and Hydraulic.
Allis-Chalmers-Bullock Co., Montreal.

Drilling Machines, Arch Bar
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.

Drilling Machines, Boiler.
American Tool Works Co., Cincinnati.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Connecting Rod.
John Bertram & Sons Co., Dundas, Ont
London Machine Tool Co., London.

Drilling Machines, Locomotive Frame.
John Bertram & Sons Co., Dundas, Ont
London Machine Tool Co., London.

Drilling Machines, Multiple Spindle.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill & Tool Co., Cincinnati.
Canada Machinery Agency, Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Pneumatic.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drilling Machines, Portable.
A. B. Jardine & Co., Hespeler, Ont.

Drilling Machines, Radial.
American Tool Works Co, Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Bickford Tool & Drill Co., Cincinnati.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Suspension.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.

Drilling Machines, Turrett
Niles-Bement-Pond Co., New York.

Drilling Machines, Upright.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co. Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Krug & Crosby, Hamilton.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drills, Bench.
B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
King & Crosby, Hamilton.
London Machine Tool Co., London.
Pratt & Whitney Co., Hartford, Conn.
Francis Reed Co., Worcester, Mass.

Drills, Blacksmith.
Francis Reed Co., Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Centre.
Pratt & Whitney Co., Hartford, Conn
L. S. Starrett Co., Athol, mass.

Drills, Clamp.
Francis Reed Co., Worcester, Mass.

Drills Electric.
Chicago Pneumatic Tool Co., Chicago.

Drills, High Speed.
Wm. Abbott, Montreal.
Pratt & Whitney Co., Hartford, Conn.

Drills, Hand.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Horizontal.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Machine Tool Co., London.

Drills, Pneumatic.
Chicago Pneumatic Tool Co., Chicago.

Drill, Radial
London Machine Tool Co., London.

Drills, Ratchet.
A. B. Jardine & Co., Hespeler,
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.
Armstrong Bros. Tool Co., Chicago.

Drills, Rock.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.
Francis Reed Co., Worcester, Mass.
Krug & Crosby, Hamilton.

Drills, Shop View.
John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.
Chicago Pneumatic Tool Co., Chicago.
A. B. Jardine & Co., Hespeler, Ont.
New Process Twist Drill Co. Taunton, Mass.

Drop Forging Dies.
The Globe Machine and Stamping Co. Cleveland, Ohio.

Drying Apparatus of all Kinds.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dump Cars
The Owen Sound Iron Works Co. Owen Sound.

Dust Separators.
Sheldon & Sheldon, Galt, Ont.

Dynamos.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London, Ont.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
T. & H. Electric Co., Hamilton.
United Electric Co., Toronto.
Volta Electric Repair Works, Toronto.

Economizer, Fuel
B. F. Sturtevant Co., Hyde Park, Man.

Electrical Supplies.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London, Ont.
London Machine Tool Co., London.
Packard Electric Co., St. Catharines.
T. & H. Electric Co., Hamilton.
The United Electric Co., Toronto.
Volta Electric Repair Works, Toronto.

Electrically-Driven Tools and Machinery.
Allis-Chalmers-Bullock, Montreal.
American Tool Works Co., Cincinnati.
John Bertram & Sons, Dundas.
Canada Machinery Agency, Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Electrical Repairs.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Emery Wheel Dressers.
Diamond Saw & Stamping Works, Buffalo.
The Globe Machine and Stamping Co. Cleveland, Ohio.
H. W. Petrie, Toronto.

Emery Wheel Dresser Cutters.
Diamond Saw & Stamping Works, Buffalo.

Engineers and Contractors
Canadian White Co., Montreal.
Electrical Construction Co., London.

Engineers' Supplies.
Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.
The Sylvester Mfg. Co., Lindsay, Ont.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Engines, Steam.
Allis-Chalmers-Bullock, Montreal.
The Goldie & McCulloch Co., Galt, Ont.
Jenckes Machine Co., Sherbrooke, Que.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.
The Owen Sound Iron Works Co., Owen Sound.
Waterous Engine Works Co., Brantford.

Exhaust Heads.
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Expanded Metal.
Expanded Metal and Fireproofing Co., Toronto

Expanders.
A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Sheldon & Sheldon, Galt.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Files.
Nicholson File Co., Providence, R. I.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.

Fire Apparatus
Waterous Engine Works Co., Brantford.

Fish Plates
R. Sullivan David, Montreal.

Flour Mill Machinery
Allis-Chalmers-Bullock Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.

Flue Rollers.
Chicago Pneumatic Tool Co., Chicago.

Forges.
Allis-Chalmers-Bullock, Montreal.
Boynton & Plummer, Worcester, Mass.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Forgings, Drop
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.

Forging Machinery.
National Machinery Co., Tiffin, Ohio

Friction Clutch Pulleys, etc.
The Goldie & McCulloch Co., Galt, Ont.
McLean & Sophus, Montreal.

Gang Drills.
B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co. New York.

Gas Blowers and Exhausters
B. F. Sturtevant Co., Hyde Park, Man.

Gas Plants, Suction
Wayland, Williams & Dadson, Montreal.

Gauges, Standard.
McLean & Sophus, Montreal
Pratt & Whitney Co., Hartford, Conn.

Gear Cutting Machinery.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass
Bickford Drill & Tool Co., Cincinnati.
Brown & Sharpe, Providence, R. I.
Canada Machinery Agency Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Gears, Angle.
Chicago Pneumatic Tool Co., Chicago.

Gears, Reducing.
Chicago Pneumatic Tool Co., Chicago.

Generators.
Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
The United Electric Co., Toronto.

Grinders, Centre.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati.
Pratt & Whitney Co., Hartford, Conn.

Grinders, Drill.
Wilmarth & Morman, Grand Rapids, Mich.

Grinders, Tool.
Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
Canada Machinery Agency, Montreal.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.
Wilmarth & Morman, Grand Rapids, Mich.

Grinding Machines.
Brown & Sharpe, Providence, R. I.
The Canadian Fairbanks, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Wilmarth & Morman, Grand Rapids, Mich.

Grinding and Polishing Machines.
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Wilmarth & Morman, Grand Rapids, Mich.

Hack Saws
The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
McLean & Sophus, Montreal.
H. W. Petrie, Toronto.
West Haven Mfg. Co., New Haven, Conn.
Williams & Wilson, Montreal.

Hammers, Drop
London Machine Tool Co., London.

Hammers, Pneumatic.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Hammers, Steam.
John Bertram & Sons Co. Dundas, Ont.
London Machine Tool Co., London.

Hangers
The Goldie & McCulloch Co., Galt, Ont.

Heating Apparatus.
Sheldon & Sheldon, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., High Park, Mass.

Hoisting and Conveying Machinery.
Allis-Chalmers-Bullock, Montreal.
Niles-Bement-Pond Co., New York.
The Smart-Turner Mach. Co., Hamilton.

Hoists, Pneumatic.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Hose, Air.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co. Chicago.

Hose, Couplings.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Hose, Steam
Canadian Rand Drill Co., Montreal.

Hydraulic Machinery.
Allis-Chalmers-Bullock Co., Montreal.

Indicators, Speed
L. S. Starrett Co., Athol, Mass.

Injectors.
Canada Foundry Co., Toronto.
The Canadian Fairbanks Co., Montreal.
Penberthy Injector Co., Windsor Ont.
Rice Lewis & Son, Toronto.

Iron Tools.
H. W. Petrie, Toronto.

Lace Leather.
Sadler & Haworth, Montreal.

Lamps, Arc and Incandescent
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Packard Electric Co., St. Catharines.
The United Electric Co., Toronto.

Lathe Dogs.
Armstrong Bros., Chicago
Mechanics' Supply Co., Quebec.
Pratt & Whitney Co., Hartford, Conn.

Lathes.
American Tool Work Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
The Canadian Fairbanks Co., Montreal.
London Machine Tool Co., London.
R. McDougall & Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Sebastian Lathe Co., Cincinnati, O.

Lathes, Automatic, Screw-Threading.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.
Pratt & Whitney Co., Hartford, Conn

Lathes, Turret.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
The Pratt & Whitney Co., Hartford, Conn.

Leather Belt Dressing.
Sadler & Haworth, Montreal.

Leather Belting.
Sadler & Haworth, Montreal

Leather Belting, Water-proofed.
Sadler & Haworth, Montreal.

Ledgers, Loose Leaf.
Rolla L. Crain Co., Ltd., Ottawa.

Locomotives, Air
Canadian Rand Drill Co., Montreal.

Locomotives, Steam
Canada Foundry Co., Toronto.
Canadian Rand Drill Co., Montreal

Lubricating and Oiling Devices.
Wm. W. Nugent & Co., Chicago.

Lumber Dry Kilns.
H. W. Petrie, Toronto.
Sheldon & Sheldon Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Machinery Dealers.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Machinery Exchange, Montreal.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.
Williams & Wilson Montreal.

Machinists
W. H. Banfield & Sons, Toronto.
Wm. Butler, Hamilton.
F. E. Hare, Oshawa.
Kruz & Crosby, Hamilton.

Machinists' Small Tools.
Armstrong Bros., Chicago.
Brown & Sharpe, Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Rice Lewis & Son, Montreal.
L. S. Starrett Co., Athol, Mass.
Williams & Wilson, Montreal.

Mailing Weights.
A. B. Jardine & Co., Hespeler, Ont.

Mandrels
Brown & Sharpe, Providence, R. I.
A. B. Jardine & Co., Hespeler, Ont.
The Pratt & Whitney Co., Hartford, Conn.

Measuring Machines
The Pratt & Whitney Co., Hartford, Conn

Mechanical Draft.
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Metallic Lacing.
Sadler & Haworth, Montreal.

Mill Machinery
The Goldie & McCulloch Co., Galt, Ont.
The Owen Sound Iron Works Co., Owen Sound.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Milling Attachments.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R. I.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Hartford, Conn.

Milling Machines, Horizontal.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R. I.
John Bertram & Sons Co., Dundas, Ont

London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
Pratt & Whitney, Hartford, Conn.

Milling Machines, Plain.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co. Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
Cincinnati Milling MachineCo.,Cincinnati
The Canadian Fairbanks Co., Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Milling Machines, Universal.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
Cincinnati Milling MachineCo.,Cincinnati
The Canadian Fairbanks Co., Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Milling Machines, Vertical.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.

Milling Tools.

Wm. Abbott, Montreal.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
W. T. Standish, Toronto.

Mining Machinery.

Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pnemuatic Tool Co., Chicago.
Jenckes Machine Co., Sherbrooke, Que.
T. & H. Electric Co., Hamilton.

Model Tools.

Wells Pattern and Model Works, Toronto

Motors, Electric.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Electrical Construction Co., London.
The Packard Electric Co., St. Catharines.
B. F. Sturtevant Co., Hyde Park, Man.
The United Electric Co., Toronto.
T. & H. Electric Co., Hamilton.

Motors, Air.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Nippers, Stay Bolt.

Chicago Pneumatic Tool Co., Chicago.

Nut Tappers.

John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
National Machinery Co., Tiffin, Ohio.

Oatmeal Mill Machinery.

The Goldie & McCulloch Co., Galt

Oil Filters.

Wm. W. Nugent & Co., Chicago.

Oil Pumps.

Wm. W. Nugent & Co., Chicago.

Painting Machines, Pneumatic.

Chicago Pneumatic Tool Co , Chicago.

Patent Solicitors.

Hanbury A. Budden, Montreal.
Fetherstonhough & Blackmore, Montreal
Fetherstonhaugh & Co., Montreal.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

Patterns.

Wells' Pattern and Model Works, Toronto.

Pipe Cutting and Threading Machines.

A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Oster Mfg. Co., Cleveland, O.

Planers, Standard.

American Tool Works, Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Cincinnati Planer Co., Cincinnati.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Planers, Rotary.

John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.

Planing Mill Fans.

Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Plug Drillers, Pneumatic

Canadian Rand Drill Co., Montreal.

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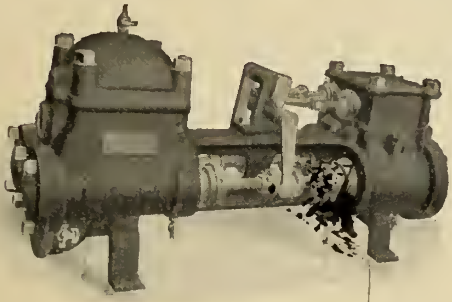

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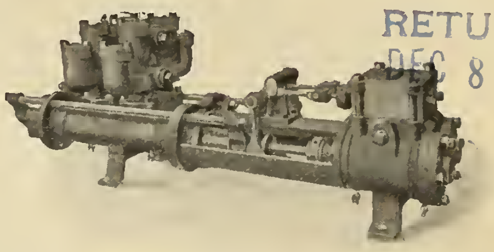

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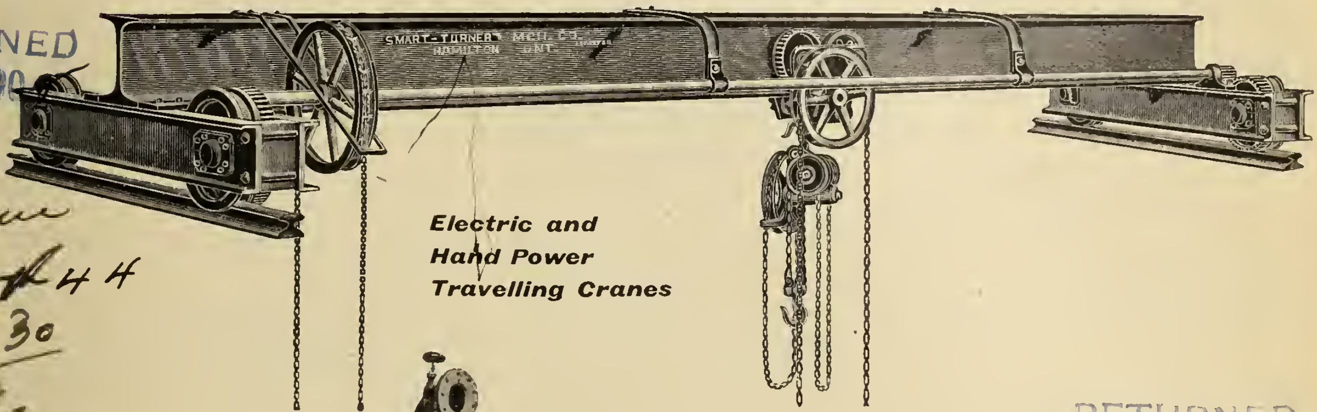

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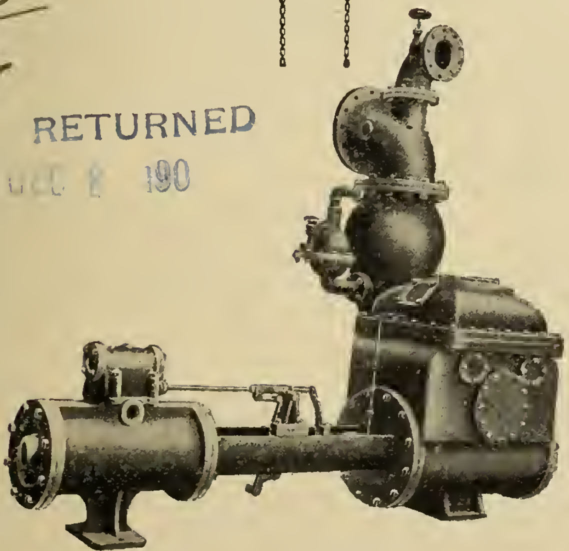

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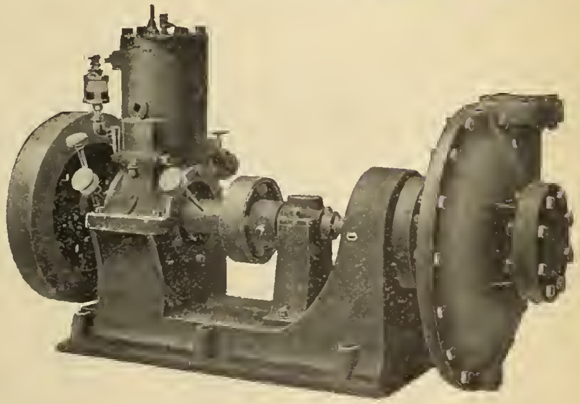

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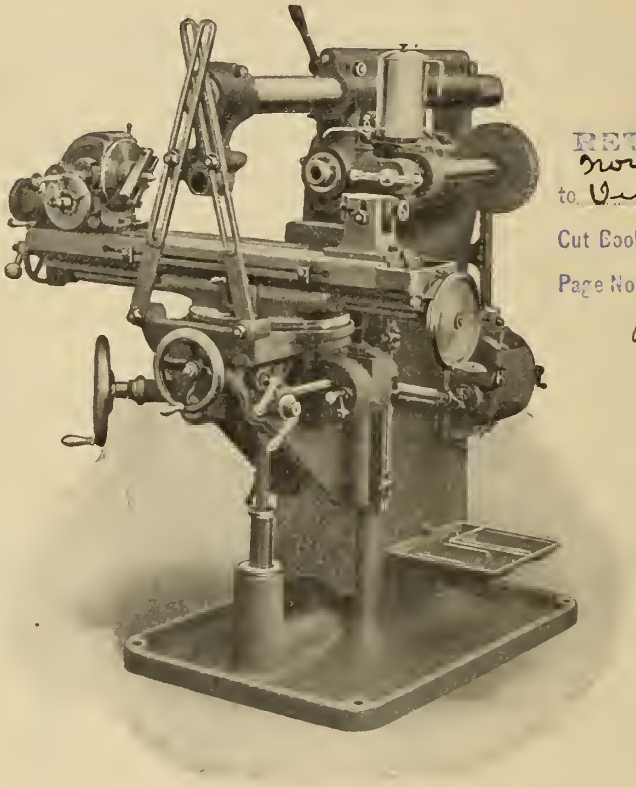

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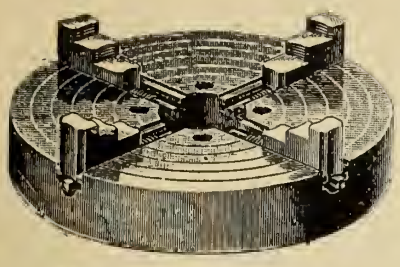

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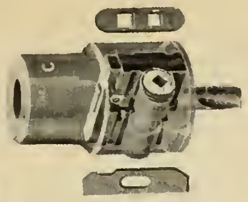

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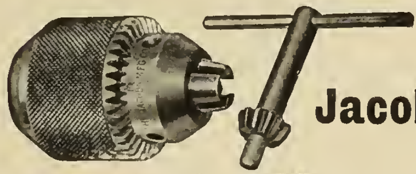

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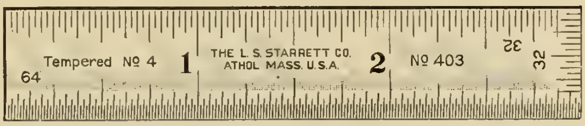

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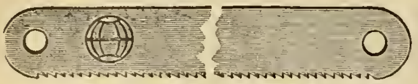

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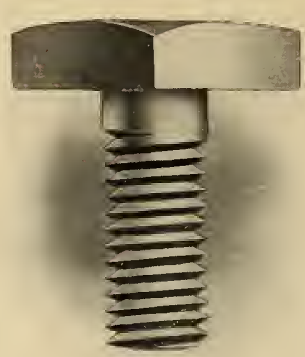

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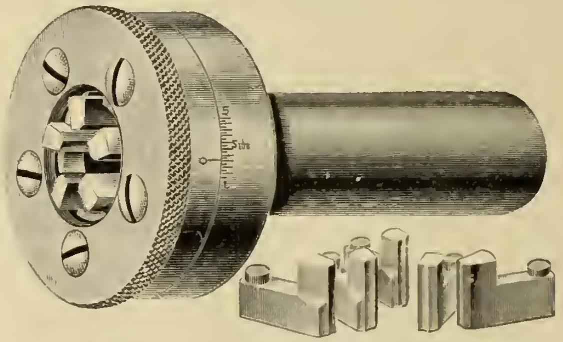

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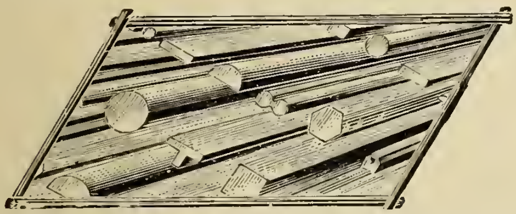

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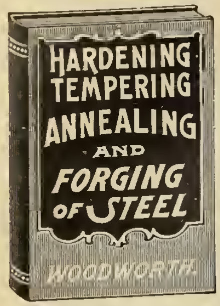

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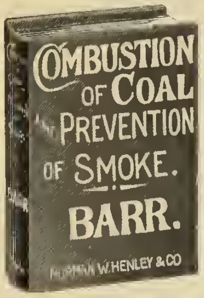

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